AIX Version 7.1

IBM Workload Partitions for AIX

IBM

Note

Before using this information and the product it supports, read the information in "Notices" on page 45 .

This edition applies to AIX Version 7.1 and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

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 collection explains how to create and manage WPARs on the AIX operating system.

Highlighting

The following highlighting conventions are used in this document:

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.
Italics	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.

What's new in IBM Workload Partitions for AIX

Read about new or significantly changed information for the IBM® Workload Partitions for AIX topic collection.

How to see what's new or changed

To help you see where technical changes have been made, the information center uses:

- The >| image to mark where new or changed information begins.
- The |< image to mark where new or changed information ends.

October 2016

The following information is a summary of the updates made to this topic collection:

- Added information about Managing software of the shared WPAR topic
- Added information about Recovering the shared WPAR that are incompatible topic.
- Updated information about Recovering detached WPARs that are incompatible topic.

WPAR concepts

The workload partition (WPAR) environment is 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.

The WPAR information describes how to install applications in a WPAR environment using various applications such as Apache, DB2® and WAS. These examples are not intended to imply that they are the only supported versions or configurations of these applications.

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 can recognize.

Applications might recognize differences in the following areas:

Device access
Some devices are accessible within a WPAR by default. Storage devices might be mounted as file systems from the global environment into the WPAR or they can be exported to the WPAR so that file systems can be created, mounted, or removed from within the WPAR. Storage device adapters might also be exported to a system WPAR which is not a versioned WPAR, giving the WPAR complete control over configuring devices for that adapter.

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. The default configuration of a WPAR prevents applications from using any raw sockets, but system administrators can enable them.

Restrictions and limitations in the WPAR environment

This section lists the restrictions and limitations in the WPAR environment.

The following functionality is unavailable within a WPAR:

- PowerHA® SystemMirror®
- RSCT
- NFS server
- WLM controls
- WPAR management
- Kernel tuning
- AutoFS must not be used in a WPAR because it might prevent the WPAR from stopping cleanly.
- Running the `halt` -*q* command inside a WPAR is expected to stop the WPAR and bring it to a defined state. Because of a timeout condition and delays while unmounting the file systems, the WPAR might not stop cleanly, which leaves the WPAR in transition state.

If the WPAR Manager licensed program is installed, there are additional restrictions on WPARs that are enabled for live mobility:

- The WPAR must either be a rootvg WPAR or NFS-based.
- The WPAR cannot have kerberos-protected NFS mounts.
- DMAPI cannot be used within the WPAR.
- Applications within the WPAR cannot use raw logical volume or disks.
- Applications cannot access /dev/mem or /dev/kmem.
- The WPAR cannot have kernel extensions exported to them.
- Files which have been mapped cannot be unlinked at the time of mobility.
- Processes cannot have stopped or debugged threads at the time of mobility.
- Processes which have been launched from the `clogin` command cannot exist at the time of mobility.

Consider the following restrictions when creating WPARs:

- WPAR partitions are not supported on thin servers (diskless and dataless systems that are not capable of starting and running without the assistance of servers on a network).
- WPAR input parameters must consist of upper or lower case ASCII letters, numbers, and underscores (_). This includes the following WPAR variables:
  - WPAR name
  - WPAR password
  - WPAR paths

- – WPAR application
- – WPAR hostname
- If a WPAR is configured to have writable, non-shared **/usr** and **/opt** filesystems, the AIX system software within that WPAR cannot be directly managed from within the WPAR. Operations that are prevented on system software include **apply**, **commit**, **deinstall**, and **reject**. If it is necessary to modify system software within a non-shared WPAR, use the **/usr/sbin/swvpdmgr -w <fileset_names>** command to allow those file sets to be directly managed within the workload partition.

Related concepts

Restrictions and limitations within a versioned WPAR
A versioned WPAR provides a different version runtime environment than the global system. Versioned WPARs have some limitations as compared to local system WPARs.

Devices

To function properly, some applications require the use of system devices.

You can export a limited set of devices or storage adapters to one or more partitions. Devices that can be exported include Fibre-Channel attached storage devices such as SCSI disk, CD, and tape devices. Applications that require access to non-exportable devices are restricted to running in the global environment. The following pseudo devices are exported to WPARs by default:

- /dev/audit
- /dev/clone
- /dev/console
- /dev/error
- /dev/errorctl
- /dev/null
- /dev/nvram
- /dev/random
- /dev/sad
- /dev/tty
- /dev/urandom
- /dev/xti/tcp
- /dev/xti/tcp6
- /dev/xti/udp
- /dev/xti/udp6
- /dev/xti/unixdg
- /dev/xti/unixst
- /dev/zero

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

Related concepts

Devices in WPARs

Different types of devices are supported by the AIX operating system, although the support of devices in the WPAR is limited to fiber-attached storage devices, fiber channel adapters, and virtual Small Computer System Interface (SCSI) disks.

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 address assigned to a WPAR appears as an alias address associated with this interface.
- The IPv4 or IPv6 address to assign to the partition.
- The network mask for IPv4 addresses or prefix length for IPv6 addresses to apply to define the local subnet.

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 **clogin** command from the global environment. The **clogin** command provides a limited function terminal to access the WPAR. It is suggested that WPARs be configured to at least have a private network configured from the global environment so that a network login function such as rlogin or telnet can be used to access the WPAR.

Related reference

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.

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.

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 operating 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.

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. Versioned WPARs can only be non-shared system WPARs.

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 -l 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:

- directory
- jfs
- jfs2
- 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.

Related concepts

Recovering detached WPARs that are incompatible
It is possible that the system software in a detached workload partition (WPAR) might become incompatible with the levels of system software in the global environment. This occurs if software installation and maintenance tasks are performed independently in the global environment and the WPAR, or if a WPAR backup image from an incompatible system level was installed.

Related information

Installing and managing software with detached WPARs

File systems for system WPARs

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

System WPARs can be created with local file system spaces, which are constructed from isolated sections of the file system space for the global environment or with a WPAR owned root volume group.

When the system WPAR isolates the file system spaces, each file system is owned and managed by the global environment. For a WPAR owned root volume group, dedicated storage devices must be allocated to the WPAR and each file system is owned and managed by the WPAR.

Global isolated file system spaces

The default location for the file system spaces is 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 and 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 on the system requirements and storage characteristics.

The following JFS2 file systems are shared from the global environment using **namefs** mounts with the following 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 can 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.

File systems in a rootvg WPAR

When a system WPAR is created with its own root volume group by using the **mkwpar** command with the **–D** flag and specifying the **disk name devname=***hdisk name* and the **rootvg=yes** option, the root file systems are created in a separate volume group that is owned and managed by the WPAR. For example, two disks can be allocated for the root volume group by using these options **-D devname=hdisk5 rootvg=yes -D devname=hdisk6 rootvg=yes**. The following JFS2 file systems are created within the WPAR-owned root volume group with inline logs, and populated similar to a stand-alone AIX operating system:

- /
- /admin
- /home
- /tmp
- /var

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

If a non-shared system WPAR is created that owns the root volume group, the /usr file system and /opt file system are created and populated within the WPAR owned root volume group. Versioned WPARs always have non-shared /usr and /opt file systems. Otherwise, the /usr file system and /opt file system are shared from the global environment by using namefs mounts.

Note: The logical volume names used within a rootvg WPAR are the same as those typically used on an AIX system. For example, /dev/hd4 would be the logical volume name for the root / file system and /dev/hd11admin for the /admin file system.

The WPAR administrator can change the file system characteristics of any file system that resides within the WPAR-owned root volume group.

File systems in a system copy WPAR

When a WPAR is created as a system copy from an AIX system or AIX system image, the file systems included in the WPAR are based on the file systems in the root volume group of the source.

If the source for creating the WPAR is an AIX system backup image, the file systems included by default in the system copy WPAR are the file systems that are listed in the image.data file from the system backup image. The system administrator can override the file system settings by using the **mkwpar** command-line option (-M) or specification files, but the administrator has the responsibility of ensuring that the resulting file system settings are sufficient to contain the files from the backup image.

If the source for creating the WPAR is a running AIX system rather than a system backup image, the default file systems for the WPAR are the mounted file systems from the rootvg of the global system, with the following exceptions:

- File systems associated with WPARs are not included by default. You can override this setting by using the **-T preserve_wpars=***yes* option to the **mkwpar** command or by setting **preserve_wpars=***yes* in a copy_controls stanza of a WPAR specification file.
- The /usr and /opt file systems from the global system are not copied if the WPAR is created as a shared WPAR. If the WPAR is created with the **-l** option or if the **privateusr=***yes* attribute is set in the general stanza of a WPAR specification file, the /usr and /opt file systems are copied into the WPAR. Otherwise, the WPAR mounts the /usr and /opt file systems in read-only mode from the global system.

A system copy WPAR can be created as a rootvg WPAR.

Related concepts

System copy WPARs
A *system copy WPAR* is a system WPAR that is created by copying the files from the root volume group of an existing AIX system or an AIX system backup image.

Rootvg WPARs
A system WPAR which is configured with its own root volume group on one or more dedicated storage devices is called a rootvg WPAR. Configuring a rootvg WPAR gives the WPAR administrator complete control over managing the storage devices exported to the WPAR, the volume groups on those devices, and the logical volumes and file systems within those volume groups. A system WPAR which is not a rootvg WPAR does not have its own root volume group, but has file systems created in logical volumes created out of the root volume group of the global system.

Related tasks

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.

Rootvg WPARs

A system WPAR which is configured with its own root volume group on one or more dedicated storage devices is called a rootvg WPAR. Configuring a rootvg WPAR gives the WPAR administrator complete control over managing the storage devices exported to the WPAR, the volume groups on those devices, and the logical volumes and file systems within those volume groups. A system WPAR which is not a rootvg WPAR does not have its own root volume group, but has file systems created in logical volumes created out of the root volume group of the global system.

For a rootvg WPAR, storage devices must be exported (or allocated) to the WPAR when it is created. After it has been created, the **chwpar** command can be used to allocate additional disks to the WPARs root volume group or, if it contains multiple disks, to deallocate a disk from the WPARs root volume group. It is not possible to change a WPAR without its own root volume group into a rootvg WPAR after it has been created.

Rootvg WPARs can be configured to support live application mobility when used in combination with *IBM PowerVM® Workload Partitions Manager for AIX*.

A configuration with a WPAR owned root volume group (a RootVG WPAR) helps to isolate the file systems and volume groups of a WPAR from the global system.

Rootvg WPAR mobility considerations
A WPAR whose file systems are all NFS mounted or all SAN based is eligible for Live Application Mobility, wherein a workload running in a WPAR on one LPAR might be moved to another compatible LPAR and execution resumed at the same point. This relocation of a WPAR involves moving its executable code to the target LPAR, while keeping the application data on the same storage devices. Thus, the storage devices containing the file systems must be visible and accessible from both LPARs.

Note: IBM PowerVM Workload Partitions Manager for AIX (WPAR Manager) is required for WPAR mobility.

A typical configuration might include two SAN based disks containing the rootvg of the WPAR, with a third SAN based disk exported to the WPAR and containing a separate volume group with application data. This gives the WPAR administrator complete control over creating new file systems or resizing the existing file systems within those volume groups. If the intent is to be able to relocate the WPAR, the WPAR Manager can be used to create the WPAR, as well as to move it between LPARs.

Related concepts

Devices in WPARs
Different types of devices are supported by the AIX operating system, although the support of devices in the WPAR is limited to fiber-attached storage devices, fiber channel adapters, and virtual Small Computer System Interface (SCSI) disks.

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

Related tasks

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.

System copy WPARs

A *system copy WPAR* is a system WPAR that is created by copying the files from the root volume group of an existing AIX system or an AIX system backup image.

A system copy WPAR contains configured files and file systems directly from its source. A system copy WPAR differs from a standard system WPAR because it contains the files and file systems from the root volume group of the source system. A standard WPAR is created as a newly installed system by installing new and unconfigured root parts of filesets into a default set of files.

Related concepts

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

Creating a WPAR as a system copy
Instead of installing a WPAR with the default set of files, you can create a WPAR as a copy of an existing system.

Security

WPARWPARs 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
- 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 reference

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 **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.

Note: Using hard maximum limits can have a significant impact on system or application performance if not used appropriately. Because imposing hard limits can result in unused system resources, in most cases, soft maximum limits are more appropriate.

Versioned workload partitions

A versioned workload partition (WPAR) provides a different version runtime environment than the global system.

Support for AIX 5.2 or AIX 5.3 versioned WPARs requires installation of additional licensed program products:

• AIX 5.2 workload partitions for AIX 7

• AIX 5.3 workload partitions for AIX 7

The versioned WPARs do have some limitations as compared to local system WPARs. A versioned WPAR has a runtime environment from an older AIX system backup and runs on a global system with a newer level of AIX. The AIX commands and libraries inside the WPAR support the older AIX level's syntax and

semantics, even though the AIX kernel on the system is running a newer level. Applications running in the versioned WPAR need not be aware that the global system is a different version. However, there are some limitations related to running in any WPAR that might affect some applications.

A **mksysb** backup of a system running the earlier version of AIX is used to create the versioned WPAR.

Applications running in a versioned WPAR use the commands and libraries from the operating system files where the backup was made to create the versioned WPAR. If you have applications that have not been certified on newer versions of the AIX operating system, the versioned WPAR commands and libraries provide a way to run them in the original AIX environment on top of an AIX 7.1 kernel. Such a setup allows running those applications on currently available hardware that might not support the use of the older AIX level as the base operating system. A versioned WPAR is always a system WPAR and is not shared. Versioned WPARs own writable `/opt` and `/usr` file systems.

SMIT panels for administering versioned WPARs are available using SMIT fast path **vwpar**.

Requirements for versioned WPARs

There are some requirements for your system when you create versioned WPARs.

- Versioned WPARs support only POWER7® and POWER8® hardware.
- Requirements for AIX 5.2 versioned workload partitions:
  - AIX 5.2 WPARs can be installed only on an AIX 7.1 operating system or later. Additionally, version 1.1.2 of the `vwpar.images` package must be installed on an AIX 7.1 operating system at Technology Level 2, or later.
  - The minimum level of AIX 5.2 that can be used within an AIX 5.2 workload partition is AIX 5.2 with Technology Level 10, and Service Pack 8. Therefore, any backup image that is used to create an AIX 5.2 WPAR must be from an AIX 5.2 operating system running the latest version.
- Requirements for AIX 5.3 versioned workload partitions:
  - AIX 5.3 WPARs can be installed only on an AIX 7.1 operating system at Technology Level 1, or later. Additionally, version 1.1.2 of the `vwpar.images` package must be installed on an AIX 7.1 operating system at Technology Level 2, or later.
  - The minimum level of AIX 5.3 that can be used within an AIX 5.3 workload partition is AIX 5.3 with Technology Level 12 and Service Pack 4, or later. Therefore, any backup image that is used to create an AIX 5.3 WPAR must be from an AIX 5.3 system running Technology Level 12 and Service Pack 4, or later.

Related concepts
Additional software required for Live Application Mobility of versioned WPARs

Installing support for versioned WPAR

The versioned workload partition product associated with the level of AIX WPAR to be created, must be installed on the system.

The product media contains required installation images to support the creation of versioned workload partitions along with optional software which provides System Management Interface Tool (SMIT) support for creating and managing versioned WPARs.

To install the required image support for versioned WPARs from CD, use the following command:
```
installp -acXY -d /dev/cd0 vwpar.images
```

Restrictions and limitations within a versioned WPAR

A versioned WPAR provides a different version runtime environment than the global system. Versioned WPARs have some limitations as compared to local system WPARs.

Limitations of functions within a versioned WPAR follow:

- File systems cannot be shared with other WPARs.

- Commands and features not supported by the AIX version of the runtime environment are not supported in the WPAR, even though they might be available in the global system.
- Adapters cannot be exported to a versioned WPAR.
- If a rootvg WPAR is created, the standard JFS file systems are not supported. When the file systems are created on a WPAR-owned rootvg, the JFS file systems from the system image are converted to JFS2 file systems.
- Some commands from the AIX 7.1 environment replace commands from the original AIX environment that used to populate the versioned WPAR, including but not limited to the following types of commands:
  - File system commands
  - Logical volume commands
  - System performance commands

  To see the files within a versioned WPAR that are replaced by local or alternative programs, run the following command within the versioned WPAR:

  ```
  ODMDIR=/usr/lib/objrepos odmget file_overlay | awk '$1=="path" {print $3}'
  ```

  If you have AIX 5.2 Workload Partitions for AIX 7 version 1.1.0, run the following command:

  ```
  ODMDIR=/usr/lib/objrepos odmget overlay | awk '$1=="path" {print $3}'
  ```

Unlike local system WPARs, it is possible for applications running within a versioned WPAR to access a limited number of symbols through the /dev/kmem interface in read-only mode. The accessible symbols are as follows:

- avenrun
- cpuinfo
- enter_dbg
- iostat
- pacefork
- sysinfo
- tickadj
- v_exempt_secs
- v_min_process
- v_repage_hi
- v_repage_proc
- v_sec_wait
- vmminfo

Versioned workload partitions use the device configuration methods from the global logical partition (LPAR), because they depend on device drivers in the kernel and therefore must have a compatible version. However, there is predefined device configuration data that the configuration methods depend on that is maintained separately in the WPAR, because all versioned WPAR are detached WPAR with their own private copy of the **/usr** file system, which stores the device configuration data. This might cause issues if the predefined device data in the WPAR is out of sync with the corresponding data in the LPAR, because data on which the configuration methods depend might be incorrect or missing. This out-of-sync condition occurs when the global LPAR is updated and the updates include new or changed predefined device data. It can also occur if the global LPAR base level is newer than the AIX release that was current when the **vwpar** product was shipped. The static updates to the predefined device data when the **vwpar** filesets are installed in the WPAR do not include the most recent data. The predefined device configuration data in the WPAR might be synchronized with the global LPAR by using the **-c** option of the **syncwpar** command.

Related concepts

This section lists the restrictions and limitations in the WPAR environment.

Creating a versioned WPAR

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

Note: The **mkwpar** command is not supported on a system that has Trusted Computing Base (TCB) installed.

Each WPAR has an isolated network environment with unique IP addresses and a unique host name. 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 must log in as the root user and perform one of the following prerequisites:

- Select a name for the WPAR that maps to an IP address for your network.
- Add an entry for the new versioned WPAR to the /etc/hosts file on the server. The entry must include the host name for the WPAR and the name of the WPAR:

  9.3.18.10 WPARname.austin.ibm.com WPARname

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

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

   ```
   host WPARname
   ```

   The return looks similar to the following:

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

   To create a versioned WPAR you must have a stand-alone system running a supported version of AIX (5.2 with Technical Level (TL)10, Service Pack (SP) 8 or 5.3 with Technical Level (TL) 12 or later) and a set of applications that you want to move to a WPAR

2. Create a **mksysb** image of an AIX 5.2 or an AIX 5.3 system that provides the content for your versioned WPAR:

   ```
   mksysb -i /mksysb_images/backupname
   ```

   Make the backup image accessible from the target system where the versioned WPAR is to be created. This can be remote access as with an NFS mount, or the backup image can be copied to the target system. The bos.wpars package must be installed on the target system.

3. Install versioned WPAR SMIT, and required installation images from the installation media. Example, using NIM:

   nimclient -o cust -a lpp_source=wparlppsource -a installp_flags=aXY -a
   filesets="vwpar.images vwpar.sysmgt"

   An example from command line: installp -qaXYd installation_device vwpar.images
   vwpar.sysmgt

4. Configure the WPAR by running the following command:

   mkwpar -n WPARname -C -B /mksysb_images/backupname

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

   ```
   mkwpar: Extracting file system information from backup...
   mkwpar: Creating file systems...
     /
   Creating file system '/' specified in image.data
    /bff
   Creating file system '/bff' specified in image.data
     /home
   ```

```
Creating file system '/home' specified in image.data
  /opt
Creating file system '/opt' specified in image.data
  /proc
  /tmp
Creating file system '/tmp' specified in image.data
  /usr
Creating file system '/usr' specified in image.data
  /var
Creating file system '/var' specified in image.data
Mounting all workload partition file systems.
New volume on /mnt/my52backup.bff:
  Cluster 51200 bytes (100 blocks).
     Volume number 1
     Date of backup: Wed Sep  9 13:50:34 2009
     Files backed up by name
     User root
x          5477 ./bosinst.data
x          7931 ./image.data
x         55973 ./tmp/vgdata/rootvg/backup.data
x             0 ./bff
x             0 ./bff/lost+found
x             0 ./opt
...
```

It continues restoring all files from the mksysb image. 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. After restoring all the files, the output from the **mkwpar** command then continues
with the installation of several file sets into the WPAR. At the end of the installation phase, you can
see an output similar to the following (The sample output shown below is from creation of an AIX 5.2
WPAR):

```
installp: APPLYING software
for: vwpar.52 7.1.0.0 .
         . .


. . << Copyright notice  for vwpar.52 >> .  . . . . . . Licensed
 Materials - Property of IBM

 Copyright
   International Business Machines Corp. 2010. All

 rights reserved. US
 Government Users Restricted Rights - Use, duplication or disclosure restricted
 by GSA ADP Schedule Contract with IBM Corp. .
. . . . << End of copyright notice for cre.base >>. . . .

Finished processing all filesets.  (Total time:  29 secs).

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

Installation Summary
--------------------
Name                       Level           Part        Event       Result
-------------------------------------------------------------------------------
bos.wpars                  7.1.0.0         USR         APPLY       SUCCESS
bos.wpars                  7.1.0.0         ROOT        APPLY       SUCCESS
wio.common                 7.1.0.0         USR         APPLY       SUCCESS
wio.common                 7.1.0.0         ROOT        APPLY       SUCCESS
vwpar.52                   7.1.0.0         USR         APPLY       SUCCESS
vwpar.52                   7.1.0.0         ROOT        APPLY       SUCCESS
Workload partition WPARname created successfully.
mkwpar: 0960-390 To start the workload partition, execute the following as root:
 startwpar [-v] 'WPARname'
```

The configuration of the system WPAR is now complete.

5. Start the WPAR by using the **startwpar** command.

Related concepts
Configuring application WPARs

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

Additional software required for Live Application Mobility of versioned WPARs

Preparing an AIX 5.2 versioned Workload Partition for Live Application Mobility

For AIX 5.2 workload partitions, the versioned WPAR must first be created, then the following software must be applied within each versioned WPAR environment that is to be configured for live mobility:

- APAR IZ72315
- APAR IZ90201

The required system updates for preparing an AIX 5.2 versioned Workload Partition for Live Application Mobility are included on the AIX 5.2 WPAR product media in the `aix52_updates` directory. To copy these images to the AIX 5.2 versioned WPAR, mount the product media into a directory on the global system, then copy all of the images from the `aix52_updates` directory to the AIX 5.2 WPAR, as in the following example for AIX 5.2WPAR my52wpar:

```
# mount -vcdrfs /dev/cd0 /mnt
# startwpar my52wpar
# mkdir /wpar/my52wpar/tmp/aix52_updates
# cp /mnt/aix52_updates/* /wpar/my52wpar/tmp/aix52_updates
```

Log in to the WPAR and apply the updates:

```
my52wpar# install_all_updates -d /tmp/aix52_updates
```

The software for APAR IZ72315 and APAR IZ90201 is included on the product installation media under directory `/aix52_updates`.

Preparing an AIX 5.3 versioned Workload Partition for Live Application Mobility

For AIX 5.3 workload partitions, the software to enable live application mobility for a AIX 5.3 WPAR might either be applied to the AIX 5.3 system from which the system backup image is derived, or it might be applied within the AIX 5.3 workload partitions. The following software update must be applied before live application mobility can be enabled for the AIX 5.3 workload partitions:

- APAR IZ89583

APAR IZ89583 is available through regular AIX 5.3 support channels.

Related information
Requirements for versioned WPARs
There are some requirements for your system when you create versioned WPARs.

Versioned WPAR file system and network considerations

File system considerations: By default, the file system characterizations for a versioned WPAR are derived from the characteristics of the source system from which the backup was made. The logical volume characteristics from the backup are not used by default. The **-M** flag of **mkwpar** might be used to set file system characteristics as with a regular WPAR. It is the responsibility of the administrator to determine the amount of space required for the WPAR if **-M** is used.

Additional options that can be used to control the file system characteristics of a versioned WPAR follow:

-g
Set the default volume group to use for the WPAR. The default is rootvg.
-L shrink=yes
Use only the minimum file system space for the WPAR.

-L ignore_lvs=no

> Use the logical volume characteristics from the backup for the WPAR. Use this option only if you have a good understanding of LVM, because the characteristics from the backup can conflict with logical volumes on the target system.

-L image_data=none

> Ignore all file system characteristics from the backup. There must be `-M` mount specifications for the base file systems (`/`, `/usr` `/opt`, `/home`, `/tmp`, and `/var`) in this case or else the default characteristics for a regular WPAR are used.

Network considerations: Network characteristics from a restored system are not preserved. The network characteristics are established from the network and host name specifications that were used when the system created the versioned WPAR.

Devices in WPARs

Different types of devices are supported by the AIX operating system, although the support of devices in the WPAR is limited to fiber-attached storage devices, fiber channel adapters, and virtual Small Computer System Interface (SCSI) disks.

Inactive WPAR

With an inactive WPAR, a storage device can be allocated and de-allocated to any number of WPARs. The first WPAR that starts takes ownership of the device, which means that device will be unconfigured in the global environment and reconfigured in the WPAR. You can not make any configuration changes on the device in the global environment when the device is in use by the WPAR. There are no restrictions on removing a device from an inactive WPAR.

Active WPAR

There are two ways that a device can be allocated to an active WPAR.

- If a device is not in use by another WPAR, the **cfgmgr** command allocates the device to the WPAR and makes the device available for use in the WPAR.

- If a device is in use by another WPAR, it is added to the WPAR file configuration. This device is not made accessible to the WPAR because it is already in use by another WPAR.

When an active WPAR has control of a device, the device is in the defined state in the global environment. No configuration operations are allowed on the device as long as it is in the global environment. Commands such as **mkdev, chdev, rmdev,** and **cfgmgr** will not work on the device. In order for the global environment to take control of the device, it has to be deallocated from the WPAR that has control over it.

Supported storage devices

The disk drives that are supported in a WPAR include any Fibre Channel disk drive that is supported by AIX Version 7.1 and uses the **scsidisk** device driver with the AIX Multiple Path I/O (MPIO) (default PCM) multipath software. These include the following storage systems:

- IBM System Storage® DS3400
- IBM System Storage DS4200
- IBM TotalStorage™ DS4300 (FAStT600)
- IBM TotalStorage DS4500 (FAStT900)
- IBM System Storage DS4700
- IBM System Storage DS4800
- IBM System Storage DS5100
- IBM System Storage DS5300

- IBM XIV® Storage System

The tape drives that are supported in a WPAR are any Fibre Channel tape drives that are supported by AIX Version 7.1 and use the **sctape** device driver.

Note: The **atape** device driver is not supported.

WPAR storage device limitations

The following limitations apply to WPAR storage devices.

- A storage device can be exported to only one active WPAR.
- The JFS2 file system must be used for disk storage devices.
- To use the WPAR storage device feature, the wio.common and wio.fcp packages must be installed.
- WPARs with storage devices are not supported in non-root user environment.

Related concepts
Devices
To function properly, some applications require the use of system devices.

Rootvg WPARs
A system WPAR which is configured with its own root volume group on one or more dedicated storage devices is called a rootvg WPAR. Configuring a rootvg WPAR gives the WPAR administrator complete control over managing the storage devices exported to the WPAR, the volume groups on those devices, and the logical volumes and file systems within those volume groups. A system WPAR which is not a rootvg WPAR does not have its own root volume group, but has file systems created in logical volumes created out of the root volume group of the global system.

Deploying a storage device

A device can be allocated to a WPAR when the WPAR is created or added to the WPAR in a later operation.

To deploy a device to a WPAR, you can use the **mkwpar -D** command or the **chwpar -D**.

In order for a device to be allocated to a WPAR, the device must be in the available state or the defined state in the global environment.

System WPARs can import one or more storage devices. Non-rootvg volume groups, logical volumes, and file systems can be created and managed on imported storage devices within the WPAR.

A storage device is deployed to a WPAR in the following phases:

- Use the **mkwpar** or **chwpar** command to allocate a device to a WPAR.
- The device is automatically exported to the WPAR when the WPAR starts.
- The device is automatically imported when the WPAR is booted with the **cfgmgr** command.

After the device is exported to a WPAR, the device state is listed as `Defined` and it is not available in the Global environment until it is unexported by using either the **chwpar -K -D** command or the **stopwpar** command.

Related information
lsdev command
chwpar command
mkwpar command

Allocating a device

The allocation process consists of providing a storage device that can be used by the WPAR.

A device can be allocated to a WPAR when the WPAR is created or it can be added to WPAR in a later operation. For a device to be allocated to a WPAR, it must be in the available state or the defined state in the global environment.

To query the device state, run the following command:

```
lsdev -l <device>
```

A device can be allocated to more than one WPAR, but can be used only by one WPAR at a time. To allocate a device while creating the WPAR, run the following command:

```
mkwpar -D devname=<device name> -n <wpar name>
```

For a rootvg WPAR, the device to hold the rootvg must be specified, as in the following example:

```
mkwpar -D devname=<device name> rootvg=yes -n <wpar name>
```

The **-D** parameter can be repeated to specify multiple storage devices. The *devid* attribute can be used if the unique device identifier for the storage device is known. The *devid* and *devname* attributes cannot be specified together.

```
mkwpar -D devid=<unique device id> -n <wpar name>
```

To allocate a device to an existing WPAR, run the following command:

```
chwpar -D devname=<device name> <wpar name>
```

Additional disks can be allocated to a WPARs root volume group with the following command:

```
chwpar -D devname=<device name> rootvg=yes <wpar name>
```

When you allocate a storage device to an active WPAR, the device is exported to the WPAR unless it was previously exported. To import the newly allocated device into the WPAR, invoke the **cfgmgr** command within the WPAR.

A storage device can be allocated to more than one WPAR. However, the device can be exported to only one WPAR at a time. The device is exported to the WPAR that starts first. After a device is exported to a WPAR, the extended state of the device is listed as Exported. To see the extended state of a device, run the following **lsdev** command with the new **-x** flag:

```
lsdev -x -l hdisk1
```

A message similar to the following example is displayed:

```
hdisk1 Exported 01-08-02 MPIO Other DS4K Array Disk
```

Deallocating a device

To deallocate a storage device from an existing WPAR, run the following command from the global environment:

```
chwpar -K -D devname=<device name> <wpar name>
```

When a storage device is deallocated from an inactive WPAR, the device is removed from the WPAR configuration. When a storage device is deallocated from an active WPAR, the **chwpar** command attempts to unconfigure the device. If the device is used, the unconfiguration operation fails and the command to remove the device from the WPAR also fails. When the command is successful, the device in the WPAR changes from the available state to the defined state.

Related information
chwpar command
lsdev command

Configuring a device in a WPAR

Every device that is configured in the workload partition WPAR has an Object Data Manager (ODM) entry in the WPAR.

The storage device has a parent device that is a virtualized device. You can not make any configuration changes on the parent device in the WPAR, or modify any management paths to the device.

The following commands are used to configure and manage the global environment, and are also used in the same manner to configure and manage devices in the WPAR:

- **cfgmgr**
- **chdev**
- **lsattr**
- **lsdev**
- **lspath**
- **mkdev**
- **rmdev**

Related information
mkdev command
chdev command
rmdev command
lsdev command
cfgmgr command
lsattr command
lspath command

Managing file systems for a device

When the device is configured in a rootvg WPAR, commands that are used to create and manage volume groups, logical volumes, and file systems operate in the same manner as in the global environment.

To create and modify volume groups, use the following commands:

- **exportvg**
- **extendvg**
- **importvg**
- **mkvg**
- **reducevg**

To create and modify logical volumes, use the following commands:

- **chlv**
- **mklv**

To create and modify file systems, use the following commands:

- **chfs**
- **mkfs**

For more information about the commands, see Commands.

Related information
mkvg Command
importvg Command
exportvg Command
extendvg Command

reducevg Command
chlv Command
mklv Command
mkfs Command
chfs Command

Application WPARs

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 usage 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 reference
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.

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.

Related information
Installing and managing software with detached WPARs

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/consdef
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 **mkwpar** 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...

SUCCESSES
---------
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 WPARs /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...

     /opt/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.

Creating a WPAR as a system copy

Instead of installing a WPAR with the default set of files, you can create a WPAR as a copy of an existing
system.

The default method of creating a WPAR populates the new partition with a default set of installation files,
system configuration files, and file systems. An alternative approach is to create a WPAR as a copy of an
existing system.

A system copy WPAR can be created as a copy of the running system or it can be created from a system
backup image.

The WPAR that is created as a system copy contains all of the files and file systems from the source root
volume group, with the following exceptions:

- Filesets that were marked as not visible in a WPAR from the global system or the system backup
  image are removed from the WPAR unless **-T preserve_private=yes** is specified on the **mkwpar**
  command line or the **preserve_private** attribute of a **copy_controls** stanza is set to *yes* in a WPAR
  specification file.
- File systems that are associated with WPARs on a running system are excluded from a system
  copy WPAR created from that system unless **-T preserve_wpars=yes** is specified on the **mkwpar**
  command or the **preserve_wpars** attribute of a **copy_controls** stanza is set to yes in a WPAR

specification file. The **preserve_wpars** attribute is ignored when a WPAR is created from a system backup image.

- Customized device information from the source is not copied into the WPAR. The customized device information within the created WPAR reflects the devices that are available to the WPAR.

A system copy WPAR that is created from a system backup image must be at the same system level as the hosting system before the WPAR can be started or become active. If the levels are not compatible, the administrator must use the **syncwpar** command to bring the WPAR to the level of the hosting system. The initial level of the system backup image must be at least AIX 4.3.3.

The **-G** and **-x** options to the system backup commands enable a system backup image to be used to create a system copy WPAR. The **-x** flag is only necessary if the /usr and /opt file systems need to be excluded from the system backup image to create a shared WPAR from the system copy.

Related concepts

System copy WPARs
A *system copy WPAR* is a system WPAR that is created by copying the files from the root volume group of an existing AIX system or an AIX system backup image.

Related information

mkcd Command
mkdvd Command
mksysb Command
mkszfile Command
mkwpar Command
syncwpar Command

Creating a system copy WPAR from a system backup image
Creating a system copy WPAR from a backup image of a system that has a similar structure and configuration is easier than creating a default WPAR and configuring it manually.

To create a system WPAR as a copy of a backup image, enter the following command where *device* represents a file or device that contains an AIX system backup image created by **mksysb**, **mkcd**, or **mkdvd**:

```
mkwpar -t -B device -n WPARname
```

Related tasks

Creating a system copy WPAR from the running system
Creating a system copy WPAR based on a running system that is similar provides an easier way to create a WPAR than configuring it manually.

Creating a system copy WPAR from the running system
Creating a system copy WPAR based on a running system that is similar provides an easier way to create a WPAR than configuring it manually.

To create a system WPAR as a copy of the currently running system, use one of the following methods:

- Enter the **mkwpar** command with the **-t** option

  ```
  mkwpar -t [-l] -n WPARname
  ```

- Set the general attribute **system_copy** to *yes* in a WPAR specification file.

  ```
  system_copy=yes
  ```

Related tasks

Creating a system copy WPAR from a system backup image

Creating a system copy WPAR from a backup image of a system that has a similar structure and configuration is easier than creating a default WPAR and configuring it manually.

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
```

Related information
mkwpar command
chwpar 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

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 workload partition (WPAR) by using the **mkwpar** command with the -M option. Customized file systems can be added to an existing system WPAR by using the **chwpar** command with the -M option. A WPAR might use namefs mounts from any type of file system that supports POSIX file system semantics when mounted with a namefs mount. If the namefs mount is used for the root file system of the WPAR, the used file system must support the creation and use of block and character devices within the WPAR.

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.

Note: If the -M option is used with the **mkwpar** command for a rootvg system WPAR, or with the **chwpar** command for an active system WPAR, the only valid value for the *vfs* attribute is *namefs*.

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 /wpars/wparname/usr/local with the type=wparname option.

Related concepts

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

Rootvg WPARs
A system WPAR which is configured with its own root volume group on one or more dedicated storage devices is called a rootvg WPAR. Configuring a rootvg WPAR gives the WPAR administrator complete control over managing the storage devices exported to the WPAR, the volume groups on those devices, and the logical volumes and file systems within those volume groups. A system WPAR which is not a rootvg WPAR does not have its own root volume group, but has file systems created in logical volumes created out of the root volume group of the global system.

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. The -N flag specifies network configuration attributes, and is used to separate the `attribute=value` pairs by blank spaces. You can specify more than one -N flag to configure multiple IP addresses. 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
```

To configure a system WPAR with an IPv6 network address of fe80::200:254 using the en3 interface from the global environment, run the following command:

```
mkwpar -n wpar_name -N interface=en3 address6=fe80::200:254 prefixlen=64
```

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:

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

Related concepts

Networking
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 **chwpar** 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 **chwpar** command:

```
chwpar -h new_hostname wpar_name
```

Related information

mkwpar command
chwpar command

Removing a network from a system WPAR

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

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

```
chwpar -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 **chwpar -K** command and add the network with the new address.

Related information

chwpar command

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 **chwpar** command. Any changes to the domain resolution configuration of an existing WPAR must be made by manually editing the relevant files.

Configuring WPAR-specific routing

You can configure a WPAR to use its own routing table using the **-i** flag and the **-I** flag for the **mkwpar** command, the **wparexec** command, or the **chwpar** command.

By default, system and application workload partitions with active network connections share the global system's routing table. To enable WPAR-specific routing for a WPAR when you are creating the WPAR, add the **-i** flag to the command line of the **mkwpar** command or the **wparexec** command. For system WPARs:

```
mkwpar -n wpar_name -N network_attributes -i ...
```

For application WPARs:

```
wparexec -N network_attributes -i ... -- /path/to/application arg1 arg2 ... argN
```

Using these commands will automatically create loopback, broadcast, and subnet routes appropriate to each configured address. If you do not specify any explicit routing table entries, the WPAR will only be able to communicate within its own subnets. You can configure explicit routing table entries with **-I** flag when you create the WPAR. You can configure zero or more explicit routing table entries. Each entry requires its own instance of the **-I** flag. Destination and gateway addresses can be specified by symbolic name or IP address.

For example, to configure a default route through a gateway with symbolic name gateway.customer.com and a host route to myserver.customer.com through gateway 192.168.1.1:

```
mkwpar -n wpar_name -N network_attributes -i -I rtdest=default rtgateway=gateway.customer.com \
 -I rtdest=myserver.customer.com rttype=host rtgateway=192.168.1.1 ...
```

The **netstat -r** command can be used with the **-@** flag to view the WPAR-specific routing table for a WPAR at any time. If WPAR-specific routing is disabled for the queried WPAR, the **netstat -r** command will display the global routes. The output format is identical to that of the **netstat -r** command without the **-@** flag. For example:

```
netstat -r -@ wpar_name
```

You can change the WPAR-specific routing characteristics for both system WPARs and application WPARs using the **chwpar** command. The changes can be performed on active WPARs or inactive WPARs. Changes take effect immediately, and persist across system WPAR reboots. To disable WPAR-specific routing, causing the affected WPAR to begin using the global routing tables, use the following command:

```
chwpar -K -i wpar_name
```

To enable WPAR-specific routing and add a route for destinations in subnet 224.128.9.0/24 through gateway 224.128.9.1 on interface en4, use the following command::

```
chwpar -i -I rtdest=224.128.9.0 rtnetmask=255.255.255.0 rtgateway=224.128.9.1 rtinterface=en4 wpar_name
```

To delete an existing WPAR-specific route entry, you must provide enough information to identify the entry being deleted. In most cases, it is effective to use the same attributes provided when the route was configured. For example, use the following command to remove the route configured in the previous example:

```
chwpar -K -I rtdest=224.128.9.0 rtnetmask=255.255.255.0 rtgateway=224.128.9.1 rtinterface=en4 wpar_name
```

Related concepts

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

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 **chwpar** 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 **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
```

Related concepts
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.

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.

Related information
mkwpar command

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
```

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.

Related concepts
Configuring WPAR-specific routing
You can configure a WPAR to use its own routing table using the **-i** flag and the **-I** flag for the **mkwpar** command, the **wparexec** command, or the **chwpar** command.

Related information
Creating a versioned WPAR
You can create a new versioned WPAR with the **mkwpar** command.

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
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. The `-N` flag specifies network configuration attributes, and is used to separate the `attribute=value` pairs by blank spaces. You can specify more than one `-N` flag to configure multiple IP addresses. 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
```

To configure an application WPAR with an IPv6 address of fe80::200:214 using the en3 interface from the global environment, run the following command:

```
wparexec -N interface=en3 address6=fe80::200:214 prefixlen=64 \
-- /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
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.

Managing WPARs

After you have a WPAR created and configured, you might want to perform tasks such as removing,
restoring, and listing WPARs.

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 UUID
An universally unique ID that is associated with a WPAR. It can be specified when the WPAR is
created, otherwise the ID is generated automatically. The UUID is stored in the WPAR configuration
and persists until the WPAR is removed. The UUID can be changed with the **chwpar** command.

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
```

To display the UUID of a WPAR, run the **lswpar** command with the `-a` flag as follows:

```
lswpar -a UUID wpar_name
```

Related information
lparstat command
uname command

Logging in to a WPAR

After you configure and activate a system WPAR that does not have a network connection, you can log in to it locally using the **clogin** command.

Note: The **clogin** command provides limited console support and some applications may not behave as they would under a full function console. The **clogin** command is primarily intended to be used to access the WPAR for maintenance to correct WPAR configuration problems. For best results, configure the WPAR to have at least a private network to enable network login mechanisms, such as rlogin and telnet.

You can log in to a WPAR as the root user or as a different user. 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 for maintenance and to create a shell as the root user, run the following command:

```
clogin wpar_name
```

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

```
clogin wpar_name -l username
```

Note: You can also log into a system WPAR remotely by using 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

Alternate bootsets for workload partitions

In a logical partition (LPAR) there are two commonly used techniques for creating a backup of the LPAR. The **mksysb** command can be used to create a backup image of the rootvg in a file or on a device, or the **alt_disk_copy** command can be used to make a copy of the rootvg disks on an alternate set of disks.

The **alt_disk_copy** command is used during a maintenance cycle. It allows the current root volume group to be saved on alternate disks before updates are applied. If any issues occur with the updated system, the LPAR can be restarted from the alternate disks to switch back to the previous system level.

In a WPAR, the **savewpar** command provides function similar to the **mksysb** command for an LPAR. You can create an alternate bootset for a WPAR that corresponds to use of the **alt_disk_copy** command in an LPAR.

The **chwpar** command with the **-B** option allows cloning of the current bootset of a WPAR to create an alternate bootset. For a file system-based WPAR, a volume group might be specified to create the alternate bootset on. If volume group is not specified, the alternate bootset is created on the same volume group where the current bootset is stored.

The **chwpar** command with the **-b** option might be used to specify a bootlist, which gives an ordered list of bootsets on which a WPAR should be started from. If the start from the first bootset in the bootlist fails, then **startwpar** command will retry to use the next bootset in the list.

The **lswpar** command also displays information about bootsets and bootlists.

Recovering incompatible shared WPAR

System software in a shared Workload Partition (WPAR) might be incompatible with the level of system software of the global WPAR. This incompatibility occurs when the updated filesets are in the APPLIED state in both the global WPAR and the shared WPAR, but not in the COMMITTED state.

When you force-install the filesets in the global WPAR, the /usr part and the /root part of the file system might become out-of-sync. To recover the shared WPAR, clean up the ObjODM entries.

Note: To clean up Object Data Manager (ODM) entries, run the savewpar operation, and then run the restwpar operation.

Managing software of the shared WPAR

The shared form (shared /usr) of a system WPAR has the **/usr** file and the **/opt** file systems mounted from the global system hosting the WPAR.

For shared system WPAR, all changes within the **/usr** file and the **/opt** file systems are immediately visible within the WPAR along with the installation files and information required to synchronize the non-shared (root) portion of the WPAR global system within the **/usr** file system. The **syncwpar** command will synchronize a shared WPAR with its global environment. You can use shared WPAR unless it is required that the /usr file systems be writable within the WPAR.

Note: When you are updating filesets in shared WPAR you must always commit the changes.

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

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 the AIX operating system. 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

Recovering detached WPARs that are incompatible

It is possible that the system software in a detached workload partition (WPAR) might become incompatible with the levels of system software in the global environment. This occurs if software installation and maintenance tasks are performed independently in the global environment and the WPAR, or if a WPAR backup image from an incompatible system level was installed.

If you use the recommended default WPAR configuration, which shares the **/usr** and **/opt** file systems with the global environment, the chances of getting incompatibility issues are less. The software in a shared WPAR comes from the global environment, and the **syncwpar** command provides functionality to complete any required installation operations for the WPAR.

When the system software in a detached WPAR has become incompatible with the global environment, you can use the **syncwpar -D** command to assist in recovering the detached WPAR that is incompatible and make it consistent with the global system. It is possible that a WPAR might ultimately remain unrecoverable, but even then it is still possible to recover the non-system files in the WPAR.

Complete the following steps to recover a detached WPAR:

1. **Installation-based detached WPAR recovery**

   Use the **syncwpar** command to perform a series of installation tasks to bring the software in the WPAR to a compatible level with the global environment. If the **-d** installation device is specified, it attempts to install software at the required levels. In order to be successful, the installation media must match the levels of installation media that were used to install the software in the global environment. The **inuwpar** command is used to perform the installation operations in the WPAR.

2. **WPAR reinstallation**

   If the recovery is not successful, the only solution is to reinstall the WPAR on the system or install a backup image of the WPAR on another system with which it is compatible. The **savewpar** command can still be used to back up the WPAR, and the **restorewparfiles** command can restore selected files from the backup after a reinstallation. Alternatively, the WPAR file systems can be mounted by using the following command:

   ```
   mount -t wpar_name
   ```

   The selected files can be backed up to a file or backup media by using the **backup** command.

Related concepts

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.

Related information

syncwpar command
inuwpar command

Managing software with detached WPARs

System WPARs exist in two basic forms as either shared or detached (non-shared /usr) workload partitions, though the file system characteristics can vary.

The shared form (shared /usr) of a system WPAR has the **/usr** file and the **/opt** file systems mounted from the global system hosting the WPAR. For shared system WPARs, all changes within the **/usr** file and the **/opt** file systems are immediately visible within the WPAR along with the installation files and information required to synchronize the non-shared (root) portion of the WPAR global system within the **/usr** file system. The **syncwpar** command will synchronize a shared WPAR with its global environment.

The detached form (non-shared /usr) of system WPAR has a separately installed writable **/usr** file and **/opt** file system. Detached WPARs provide improved flexibility by allowing the installation of different software in a WPAR than existing software in a shared WPAR environment. When it is necessary to have detached WPARs, you can use the **syncwpar** and **inuwpar** commands to manage the system software in detached WPARs and recover from situations where the WPAR has become incompatible with the global environment.

If you have WPARs on an AIX 6.1 operating system, and you migrate the global system to AIX 7.1, the software in the WPARs must also be migrated. The **migwpar** command migrates a WPAR from AIX 6.1 to AIX 7.1. The **migwpar** command can also be used to migrate a versioned WPAR from AIX 5.2 or AIX 5.3 to a native AIX 7.1 WPAR.

The **syncwpar** command cannot be used with AIX 5.2 or AIX 5.3 versioned WPARs. The software in versioned WPARs must be maintained separately from the global environment.

You can use shared WPARs unless it is required that the **/usr** file systems be writable within the WPAR. Detached WPARs increase administrative process usage due to the following unique operating environments:

- Operating system updates applied in the global environment are not immediately available in a detached WPAR.
- It is possible for the system software in a detached WPAR to become unusable and not boot if it is not compatible with the running kernel. This can happen simply by rejecting or applying updates in either the global environment or the WPAR, but not both.
- Installation files used to populate the non-shared (root) portion of a fileset reside in a packaging directory in the shared environment, but the files used to populate the **/usr** file and the **/opt** file systems in a detached WPAR are only on installation media. Thus, it is difficult to duplicate software installation steps that were taken in the global environment in the detached WPAR.

Related information
syncwpar command
inuwpar command

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 website: 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 by 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 can 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.

Using the Advanced Accounting subsystem with WPARs

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

The Advanced Accounting subsystem 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 seven 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

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.

Note: For versioned WPARs, the **-@** flag is not recognized, because it is not present in the previous run time. Some commands in a versioned WPAR have added WPAR support, and in those cases, the behavior related to the **-@** flag is described in the following table.

Table 1. Modified and enhanced AIX commands			
Command	**Flags and arguments**	**Behavior in a WPAR**	**Behavior in the global environment**
`acctcom`	- @ *WPAR name*	Not allowed in WPAR.	Executes normally displaying accounting records for WPAR named *WPAR name*.
	-@ *no argument*	Fails with `cannot open /var/adm/pacct` message	Executes normally displaying accounting records for all WPARs; a WPAR name is displayed for each record
	No -@ flag	Executes normally displaying accounting records for the WPAR	Executes normally displaying all accounting records.
`accton`	No -@ flag	Enables process accounting within the WPAR.	Enables process accounting within the global environment only.
	-@	Not allowed in a WPAR.	Enables process accounting for both WPAR and global processes.
`audit`	- @ *WPAR name*	Fails with workload partition not found message unless WPAR name is "Global".	Applies auditing command to WPAR named *WPAR name*.
`clogin`	-C *wpar name command*	Not allowed in a WPAR	Prompts for password and runs command in the WPAR or login if no command is specified
`df`		Displays information about WPAR mounted file systems only; paths are displayed relative to the WPAR root	Displays information about all file systems; paths are absolute
`domainname`	No flags	Displays domain name of WPAR	Displays domain name of system
	new domain name	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 | *hex number*	Sets host ID of WPAR if run by WPAR root	Sets host ID of system if run by global root

Table 1. Modified and enhanced AIX commands (continued)			
Command	**Flags and arguments**	**Behavior in a WPAR**	**Behavior in the global environment**
`hostname`	No flags	Displays host name of WPAR	Displays host name of system
	new host name	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 `-@` *argument*	Removes IPC objects associated with the WPAR	Removes IPC objects associated with the global environment
	`-@` *WPAR name*	Does not function unless WPAR name is "global"	Removes IPC objects associated with WPAR named *WPAR name*
`ipcs`	Without `-@` *argument*	Displays information about IPC objects created by processes within the WPAR	Displays information about 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 about all IPC objects in the system; the name of the WPAR associated with the object is listed.
	`-@` *WPAR name*	Displays no IPC information unless WPAR name is "global;" global case displays information about IPC objects associated with processes within the WPAR	Displays information about IPC objects associated with processes in the WPAR named *WPAR name*
`lslpp`	`-@` *WPAR name*	Fails with an error message	Displays software vital product data for the specified workload partition. Fails if the workload partition is inactive.
`mkclass`		Only updates the `/etc/wlm` directory; fails updating kernel data	No change in behavior

			Behavior in the global
Command	**Flags and arguments**	**Behavior in a WPAR**	**environment**
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 **cachefs** allowed	No change in behavior

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
	`-@` *WPAR name*	Does not function in a WPAR	Display network information and statistics for the WPAR specified, or all WPARs if *WPAR name* 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)

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 -@ *WPAR name* 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 about processes within the WPAR; WPAR name is included in output	Displays information about processes associated with the WPAR named *WPAR name*; 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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Index

A

active WPAR 16
Advanced Accounting subsystem 38
allocating 17
Apache
    installing 38
application
    environment 1
application WPARs
    configuring 31, 32
    creating 30
    file systems 20
    resource controls 32
    specification files 32

B

backing up 34

C

configuring
    application WPARs 31, 32
    directories 24, 31
    domain resolution 27
    file systems 24, 31
    networks 25, 31
    resource controls 28, 32
    specification files 29
    system WPARs 20, 24, 25
creating
    application WPARs 30
    system WPARs 20
    Versioned WPARs 13
    WPARs as a system copy
        from a backup image 23
        from a running system 23
customizing
    file systems 25
    system WPARs 25

D

deploying 17
device 16, 17, 19
devices 3
directories
    configuring 31
domain resolution
    configuring 27

F

file systems
    application WPARs 20

file systems *(continued)*
    configuring 31
    system WPARs 5

G

global environment 4

H

host name
    system WPARs 26

I

identifiers 33
image.data file 29
inactive WPAR 16
installing
    Apache 38

L

listing 33
logging in 34

M

managing 19

N

naming
    system WPARs 24
networks
    configuring 31

R

removing 17, 36
resource controls
    configuring 28
restoring 36

S

security 8, 9
software 39
specification files
    application WPARs 32
    configuring 29
starting
    system WPARs 24
stopping
    system WPARs 36

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