Workload Partitioning (WPAR) in AIX 6.1

WPAR systems administration and configuration

Skill Level: Intermediate

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The most popular innovation of IBM® AIX® Version 6.1 is clearly workload partitioning (WPARs). Once you get past the marketing hype, you'll need to determine the value that WPARs can provide in your environment. What can WPARs do that Logical Partitions (LPARs) could not? How and when should you use WPARs? Equally as important, when should you not use Workload Partitioning. Finally, how do you create, configure, and administer workload partitions? These topics will all be discussed in this article.

Introduction

WPARs are a bold new innovation, implemented within AIX 6.1. It allows administrators to virtualize their operating system, which allows for fewer operating system images on your IBM System p™ partitioned server. Prior to WPARs, you would need to create a new Logical Partition (LPAR) for each new "isolated" environment. This is no longer necessary (with AIX 6.1 only), as there are many circumstances when one can get along fine with multiple WPARs within one LPAR. Why is this important? Every LPAR requires its own operating system image and a certain number of physical resources. While you can virtualize many of these resources, there are still some physical resources that must be allocated to the system. Furthermore, you need to install patches and technology upgrades to each LPAR. Each LPAR requires its own archiving strategy and DR strategy. It also takes some time to create an LPAR; you also need to do this outside of AIX, through a Hardware Management Console (HMC) or the Integrated Virtualization Manager

(IVM).

WPARs are much simpler to manage and can actually be created from the AIX command line or through SMIT. LPARs cannot. By far the biggest disadvantage of LPARs is maintaining multiple images, which goes along with possibly over-committing expensive hardware resources, such as CPU and RAM. In other words, while partitioning helps you consolidate and virtualize hardware within a single box, operating system virtualization through WPAR technology goes one step further and allows for an even more granular approach of resource management. It does this by sharing OS images and is clearly the most efficient use of CPU, RAM, and I/O resources.

Rather than a replacement for LPARs, WPARs are a complement to them and allow one to further virtualize application workloads through operating system virtualization. WPARs allow for new applications to be deployed much more quickly, which is an important side-benefit. On the other side of the coin, it's important to understands the limitations of WPARs. For example, each LPAR is a single point of failure for all WPARs that are created within the LPAR. In the event of an LPAR problem (or a scheduled system outage, for that matter), all underlying WPARs will also be affected.

WPARs: How and when to use them

This section further defines the different types of workload partitions and discusses scenarios where WPARs should be used.

As discussed earlier, Workload Partitions (WPARs) are virtualized operating system environments that are created within a single AIX (only supported on AIX 6.1) image. While they may be self-contained in the sense that each WPAR has its own private execution environment with its own filesystems and network addresses, they still run inside the global environment. The global environment -- the actual LPAR -- owns all the physical resources of the logical partition. It is important to also note that the global environment can see all the processes running inside the specific WPARs.

There are two types of WPARs: system workload partitions and application workload partitions. The system WPAR is much closer to a complete version of AIX. The system WPAR has its own dedicated, completely writable filesystems along with its own inetd and cron. Application WPARs are real, lightweight versions of virtualized OS environments. They are extremely limited and can only run application processes, not system daemons such as inetd or cron. One cannot even define remote access to this environment. These are only temporarily objects; they actually disintegrate when the final process of the application partition ends, and as such, are more geared to execute processes than entire applications. Overall, WPARs have no real dependency on hardware and can even be used on POWER4 systems that do not support IBM's PowerVM (formerly known as APV). For AIX administrators,

the huge advantage of WPARs is the flexibility of creating new environments without having to create and manage new AIX partitions. Let's look at some scenarios that call for the use of WPARs.

Application/workload isolation

WPARs are tailor-made for working with test and/or QA and development environments. Most larger organizations have at least three environments for their applications. These include development, test, and production. Some environments have as many as five, including demo/training and stress/integration environments. Let's use an example of a common three-tier application environment: Web, application server, and database server. In the land of the LPARs, in an environment where one has five isolated environments, you would need to create 15 LPARs. This is where the WPAR has the most value. In this environment, we would need to create just five LPARs. How is that?

In Table 1, we have five different environments, consisting of a Web server, an application server, and a database server. If we wanted to isolate our environments, the only way to do this would be through logical partitioning. That would involve architecting 15 logical partitions. Of course, we could run some of our Web, application, and database on one LPAR, but if we did that, how would we be able to really mimic our production environments (which would run on separate partitions)? In today's world of 99.9% availability, it is extremely common to give each application environment its own home. With WPARs, we can now do that, without having separate AIX images.

Table 1. Web portal -- LPARs only

Developmen (3 lpars)	Demo/Traini (3 lpars)	Test (3 lpars)	Pre-Prod (3 lpars)	Production (3 lpars)
1.Dweb01	4.Trweb01	7.Tstweb01	10.Ppweb-01	13.Pweb01
2.Dapp01	5.Trapp01	8.Tstweb01	11.Ppapp01	14.Papp01
3.Dora01	6.Traora01	9.Tstora01	12.Ppora01	15.Pora01

Table 2 illustrates how that is done. Each environment would have its own LPAR, with three WPARs created within each LPAR. Now let's imagine if we had four Web servers, two application servers, and two database servers supporting this environment. Yikes! AIX administrators supporting Fortune 500 companies know what I'm talking about. It can be a nightmare maintaining all these environments. WPARs dramatically simplify the overall work-effort involved in administrating this environment, while at the same time minimizing the expense of having to assign physical resources to logical partitions.

Table 2. Web portal -- WPARs inside of LPARs

Developmen 1 LPAR, 3	Demo/Traini 1 LPAR, 3	Test 1 LPAR, 3	Pre-Prod 1 LPAR, 3	Production 1 LPAR, 3

WPARs	WPARs	WPARs	WPARs	WPARs
Dwparweb01	2.Trwparweb0	3.Tstwparweb01	4.Ppweb-01	5.Pweb01
1. Dwaparapp01	2.Trwpapp01	3.Tstwparapp01	4.Ppapp01	5.Papp01
1. Dwparora01	2.Trwparora01	3.Tstwparora01	4.Ppwparora05	5.Pora01

Playing nicely in the sandbox

In virtually every environment I've managed, my staff has begged to have sandbox environments in which to work. These environments would be used only by the systems administrators. It is here that administrators have the opportunity to install new software, test out new patches, install new technology levels, and generally be free to break the system without any effect to the business. Unfortunately, it is always the sandbox that is the first environment that must be given up when a new application needs to be deployed. With WPARs, you can quickly create an isolated environment in which to play. While my preference is to have several WPAR sandboxes within an overall LPAR sandbox, each of these owned by a different administrator, this now becomes less of a luxury than it used to be. Looking at this from another perspective, these WPARs are the training ground for new administrators to learn and practice their craft on. With WPARs, they can now be managed much more efficiently and created without having to assign dedicated devices to them.

Quickly testing an application

The application WPAR can be created in just a few seconds. What better way is there to quickly troubleshoot an application or wayward process? As these are temporary resources, they are destroyed as soon as they end, simplifying the manageability of these partitions.

WPARS: When not to use them

This section discusses situations and scenarios where you may not want to use WPARs.

Security

As stated previously, WPAR processes can be seen by the global environment from the central LPAR. If you are running a highly secure type of system, this may be a problem for you from a security standpoint. Further, the root administrator of your LPAR will now have access to your workload partition, possibly compromising the security that the application may require.

Performance

Each WPAR within LPAR is now using the same system resources of the LPAR. You need to be that much more careful when architecting your system and also when stress testing the system. For example, if you're running a performance benchmark on your pre-production system after a new build has been deployed and there are some developers working on the application server while you are testing your database, this will all be done within one LPAR sharing the same resources. Your teams will all need to understand that there will be competing resources now for the same product.

Availability

If you are in an environment where it is very difficult to bring a system down, it's important to note that when performing maintenance on an LPAR that every WPAR defined will be affected. At the same time, if there is a system panic and AIX crashes, every WPAR has now been brought down. From this standpoint, LPARs without WPARs can provide increased availability across your environment, albeit at a cost that may be prohibitive.

Production

I'm extremely conservative when it comes to production. I like to run each tier in production within its own logical partition. I do this because I like the granularity and complete OS isolation that LPARs provide, without having multiple environments (Web, applicatoin, and database) to worry about.

Physical devices

Physical devices are not supported within a WPAR. While there is a way to export devices, this can be a big problem for applications that require non-exportable devices. In this case, they would be restricted to only running in the global environment. For example, Oracle RAC is not supported using Solaris zones because of this limitation, and should not work in a WPAR environment for the very same reason.

Creating, configuring, and administering WPARs

This section creates, configures, and administers WPARs, both system and application.

System WPARs

The mkwpar command creates the WPAR, installs the filesystems, and prepares the system (see Listing 1). It also synchronizes the root section of the installed software.

Listing 1. The mkwpar command

```
lpar5ml162f_pub[/] > mkwpar -n devpayrollWPAR01
mkwpar: Creating file systems...
 /
 /home
 /opt
 /proc
 /tmp
 /usr
 /var

<< End of Success Section >>

FILESET STATISTICS
------------------
  241  Selected to be installed, of which:
     241  Passed pre-installation verification
  ----
  241  Total to be installed


+-----------------------------------------------------------------------------+
                       Installing Software...
+-----------------------------------------------------------------------------+


Filesets processed:  6 of 241  (Total time:  2 secs).

installp:  APPLYING software for:
       X11.base.smt 6.1.0.1
Filesets processed:  7 of 241  (Total time:  3 secs).
installp:  APPLYING software for:
       X11.help.EN_US.Dt.helpinfo 6.1.0.0
Filesets processed:  8 of 241  (Total time:  3 secs).
installp:  APPLYING software for:
       bos.acct 6.1.0.1
Filesets processed:  9 of 241  (Total time:  3 secs).
installp:  APPLYING software for:
       bos.acct 6.1.0.2
Filesets processed:  10 of 241  (Total time:  4 secs).
installp:  APPLYING software for:
       bos.adt.base 6.1.0.0
       bos.adt.insttools 6.1.0.0
Filesets processed:  12 of 241  (Total time:  4 secs).
installp:  APPLYING software for:
       bos.compat.links 6.1.0.0
       bos.compat.net 6.1.0.0
       bos.compat.termcap 6.1.0.0

Workload partition devpayrollWPAR01 created successfully.
mkwpar: 0960-390 To start the workload partition, execute the
following as root: startwpar [-v] devpayrollWPAR01
```

Depending on the type of system you are using, this generally takes between two
and four minutes. It took me two minutes and 40 seconds, installing 241 filesets on a
one-CPU POWER5 processor running at 1654 MHz. To check the status of the
WPAR, use the lswpar command (see Listing 2).

Listing 2. Use the lswpar command to check the status of the WPAR

```
lpar5ml162f_pub[/] > lswpar
Name              State  Type  Hostname          Directory
```

```
----------------------------------------------------------------------
MyTestWpar1        A      S      MyTestWpar1        /wpars/MyTestWpar1
MyTestWpar2        A      S      MyTestWpar2        /wpars/MyTestWpar2
devpayrollWPAR01   D      S      devpayrollWPAR01   /wpars/devpayrollWPAR01
```

In this case, it is still in what is called the "defined state." We'll need to use the
startwpar command to make it active (see Listing 3).

Listing 3. Using the startwpar command

```
lpar5ml162f_pub[/] > startwpar -v devpayrollWPAR01
Starting workload partition devpayrollWPAR01.
Mounting all workload partition file systems.
Mounting /wpars/devpayrollWPAR01
Mounting /wpars/devpayrollWPAR01/home
Mounting /wpars/devpayrollWPAR01/opt
Mounting /wpars/devpayrollWPAR01/proc
Mounting /wpars/devpayrollWPAR01/tmp
Mounting /wpars/devpayrollWPAR01/usr
Mounting /wpars/devpayrollWPAR01/var
Loading workload partition.
$corral_t = {
            'name' => 'devpayrollWPAR01',
            'wlm_cpu' => [
                            undef,
                            undef,
                            undef,
                            undef
                          ],
            'path' => '/wpars/devpayrollWPAR01',
            'hostname' => 'devpayrollWPAR01',
            'wlm_procVirtMem' => [
                                    -1,
                                    undef
                                 ],
            'wlm_mem' => [
                            undef,
                            undef,
                            undef,
                            undef
                         ],
            'key' => 3,
            'vips' => [],
            'wlm_rset' => undef,
            'opts' => 4,
            'id' => 0
          };
Exporting workload partition devices.
Starting workload partition subsystem cor_devpayrollWPAR01.
0513-059 The cor_devpayrollWPAR01 Subsystem has been started. Subsystem PID is 753708.
Verifying workload partition startup.
Return Status = SUCCESS.
lpar5ml162f_pub[/] >
```

You can now see that is it is in an active state (see Listing 4)

Listing 4. The WPAR is in an active state

```
lpar5ml162f_pub[/] > lswpar
Name              State  Type  Hostname           Directory
```

```
 ------------------------------------------------------------------------
 MyTestWpar1        A      S      MyTestWpar1        /wpars/MyTestWpar1
 MyTestWpar2        A      S      MyTestWpar2        /wpars/MyTestWpar2
 devpayrollWPAR01  A      S      devpayrollWPAR01  /wpars/devpayrollWPAR01

 To login, we'll use the clogin command and our hostname for the WPAR.

 Let's login: lpar5ml162f_pub[/] > clogin devpayrollWPAR01
 **************************************************************************
 *                                                                        *
 *                                                                        *
 *   Welcome to AIX Version 6.1!                                          *
 *                                                                        *
 *                                                                        *
 *   Please see the README file in /usr/lpp/bos for information pertinent to *
 *   this release of the AIX Operating System.                           *
 *                                                                        *
 *                                                                        *
 **************************************************************************
```

Let's run some standard AIX commands (see Listing 5).

Listing 5. Some standard AIX commands

```
# hostname
devpayrollWPAR01
# w
  10:59AM   up 13 mins,  1 user,  load average: 0.00, 0.00, 0.00
User     tty           login@        idle       JCPU       PCPU what
root     Global        10:59AM          1         0          0 -
# whoami
root
# ps -ef
     UID     PID   PPID  C    STIME     TTY  TIME CMD
    root  258064 573578  0 10:47:42      -  0:00 /usr/sbin/sshd
    root  340006 573578  0 10:47:55      -  0:00 /usr/sbin/rsct/bin/IBM.Servic
    root  356468 573578  0 10:47:56      -  0:00 /usr/sbin/rsct/bin/IBM.AuditR
    root  421948 573578  0 10:47:41      -  0:00 /usr/sbin/rpc.lockd -d 0
    root  471122      1  0 10:47:23      -  0:00 /usr/lib/errdemon
    root  504032 573578  0 10:47:42      -  0:00 /usr/dt/bin/dtlogin
    root  508124 643204 28 11:00:15      ?  0:00 ps -ef
    root  512114 573578  0 10:47:39      -  0:00 /usr/sbin/portmap
    root  561344 573578  0 10:47:56      -  0:00 /usr/sbin/rsct/bin/IBM.CSMAge
    root  573578      1  0 10:47:33      -  0:02 /usr/sbin/srcmstr
    root  602286      1  0 10:47:41      -  0:00 /usr/sbin/cron
    root  606358 573578  0 10:47:41      -  0:00 /usr/sbin/qdaemon
    root  630928      1  0 10:59:02      ?  0:00 clogin devpayrollWPAR01
    root  635076 573578  0 10:47:39      -  0:00 sendmail: accepting connectio
    root  643204 630928  0 10:59:02      ?  0:00 -ksh
    root  651276 573578  0 10:47:39      -  0:00 /usr/sbin/biod 6
    root  655560 573578  0 10:47:41      -  0:00 /usr/sbin/writesrv
    root  737494 573578  0 10:47:54      -  0:00 /usr/sbin/rsct/bin/rmcd -a IB
    root  741406 573578  0 10:47:39      -  0:00 /usr/sbin/inetd
    root  749714 573578  0 10:47:38      -  0:00 /usr/sbin/syslogd
    root       1      0  0 10:47:21      -  0:00 /etc/init
#
```

Your systems administrator can start and stop processes from the WPAR using the
SRC or from the command line, just as they would from the global environment. As
the Global (LPAR) system administrator, you will note that a WPAR has lots of
filesystems. The WPAR environment is created under /wpars (see Listing 6).

Listing 6. Creating the WPAR environment under /wpars

```
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] > hostname
lpar5ml162f_pub
# df -k
Filesystem     1024-blocks     Free %Used     Iused %Iused Mounted on
/dev/hd4           131072      19472   86%      8278    62% /
/dev/hd2          3538944     150480   96%     91842    70% /usr
/dev/hd9var        262144     246796    6%       522     1% /var
/dev/hd3           262144     259540    1%        56     1% /tmp
/dev/hd1           131072     130688    1%         8     1% /home
/dev/hd11admin     131072     130708    1%         5     1% /admin
/proc                   -          -    -         -      - /proc
/dev/hd10opt       262144     119804   55%      3048    11% /opt
/dev/fslv12        131072     103476   22%      2244     9% /wpars/devpayrollWPAR01/ora01
/dev/fslv13        131072     128660    2%         5     1% /wpars/devpayrollWPAR01/home
/opt               262144     119804   55%      3048    11% /wpars/devpayrollWPAR01/opt
/proc                   -          -    -         -      - /wpars/devpayrollWPAR01/proc
/dev/fslv14        131072     128424    3%         9     1% /wpars/devpayrollWPAR01/tmp
/usr              3538944     150480   96%     91842    70% /wpars/devpayrollWPAR01/usr
/dev/fslv15        131072     116448   12%       370     2% /wpars/devpayrollWPAR01/var

Here is the view from the WPAR

# hostname
devpayrollWPAR01
# df -k
Filesystem     1024-blocks     Free %Used     Iused %Iused Mounted on
/dev/fslv12        131072     103476   22%      2244     9% /
/dev/fslv13        131072     128660    2%         5     1% /home
/opt               262144     119804   55%      3048    11% /opt
/proc                   -          -    -         -      - /proc
/dev/fslv14        131072     128424    3%         9     1% /tmp
/usr              3538944     150480   96%     91842    70% /usr
/dev/fslv15        131072     116448   12%       370     2% /var
```
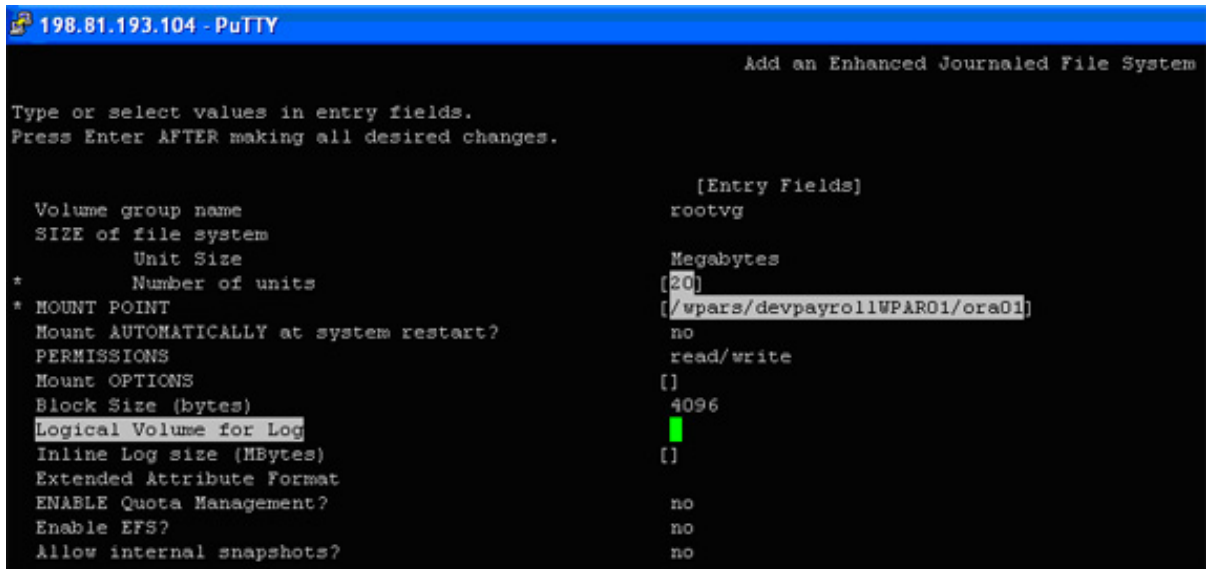
Creating filesystems

Let's turn our attention back to the global environment. Let's create a filesystem
through SMIT. You cannot create a f/s or volume group from the WPAR, only from
the global environment (LPAR).

We need to make sure that the full path of the filesystem (including the WPAR path)
is specified (see Figure 1).

Figure 1. The full path of the filesystem is specific in SMIT

Figure 2 shows the the file system has been created successfully.

Figure 2. The file system has been created successfully

After it's successfully created, you'll need to make one minor change to the filesystem: the mount group needs to be explicitly defined (see Figure 3). Note that this step is not necessary when using the command line to create the filesystem: `# smit chjfs2`.

Figure 3. Explicitly defining the mount group

```
198.81.193.104 - PuTTY
                                    Change / Show Characteristics of an Enhanced Journaled File System

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                              [Entry Fields]
    File system name                          /wpars/devpayrollWPAR01/ora01
    NEW mount point                           [/wpars/devpayrollWPAR01/ora01]
    SIZE of file system
            Unit Size                          512bytes
            Number of units                   [262144]
    Mount GROUP                               [devpayrollWPAR01]
    Mount AUTOMATICALLY at system restart?    yes
    PERMISSIONS                               read/write
    Mount OPTIONS                             []
    Start Disk Accounting?                    no
    Block Size (bytes)                        4096
    Inline Log?                               no
    Inline Log size (MBytes)                  [0]
    Extended Attribute Format                 [v1]
    ENABLE Quota Management?                  no
    Allow Small Inode Extents?                yes
    Enable EFS?                               no
```
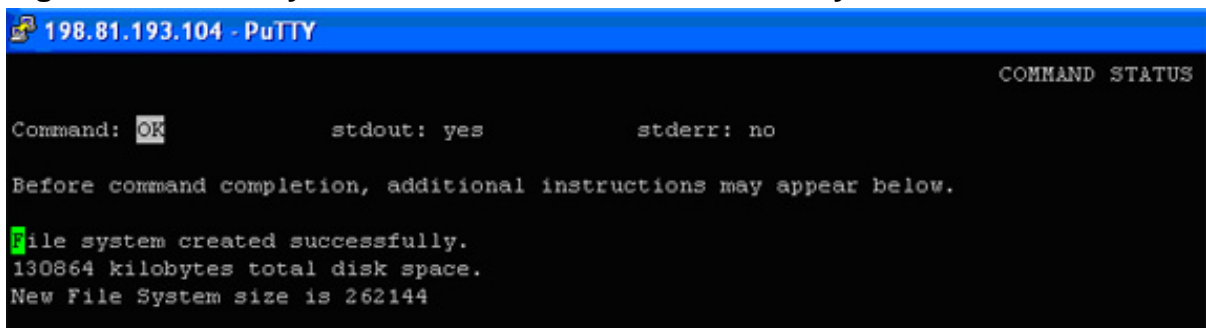
Now let's turn back to the WPAR, where you'll create the mountpoint and mount the newly created filesystem (see Listing 7).

Listing 7. Creating the mountpoint and mounting the filesystem

```
# mkdir ora
# pwd
/
# mount ora /ora01
# df -k
Filesystem    1024-blocks     Free %Used    Iused %Iused Mounted on
/dev/fslv12       131072    103444   22%     2246    9% /
/dev/fslv13       131072    128660    2%        5    1% /home
/opt              262144    119804   55%     3048   11% /opt
/proc                  -         -    -         -    - /proc
/dev/fslv14       131072    128424    3%        9    1% /tmp
/usr             3538944    150480   96%    91842   70% /usr
/dev/fslv15       131072    116448   12%      370    2% /var
/ora              131072    103444   22%     2246    9% /ora01
#
```

Note that you also cannot increase the size of a filesystem from the WPAR, only from the global environment. You also cannot serve NFS filesystems from within the WPAR; only NFS clients are supported.

Backups

Remember, there are no physical devices in a WPAR. When backing up the WPAR environment, you need to use the savewpar command, again from the global environment.

Listing 8. Using the savewpar command

```
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] > savewpar
                   -f /admin/payroll.backup devpayrollWPAR01
```

```
Creating information file for workload partition devpayrollWPAR01.

Creating list of files to back up.
Backing up 2829 files
2829 of 2829 files (100%)
0512-038 savewpar: Backup Completed Successfully.
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] >
```

You can restore using the restwpar command.

Users and groups

You can maintain users and groups within the WPAR, either from the command line
or through SMIT. You should understand that the root user for this environment does
not have access to the global environment, only to the WPAR (see LIsting 9).

Listing 9. Maintaining users and groups within the WPAR

```
# mkuser test
# mkgroup testing
# hostname
devpayrollWPAR01
# lsuser
Usage: lsuser [-R load_module] [ -c | -f ] [ -a attr attr ... ]
                                 { "ALL" | user1,user2 ... }
# lsuser test
test id=204 pgrp=staff groups=staff home=/home/test shell=/usr/bin/ksh
login=true su=true rlogin=true daemon=true admin=false sugroups=ALL admgroups=
tpath=nosak ttys=ALL expires=0 auth1=SYSTEM auth2=NONE umask=22 registry=files
SYSTEM=compat logintimes= loginretries=0 pwdwarntime=0 account_locked=false
minage=0 maxage=0 maxexpired=-1 minalpha=0 minother=0 mindiff=0 maxrepeats=8 minlen=0
histexpire=0 histsize=0 pwdchecks= dictionlist= default_roles= fsize=2097151 cpu=-1
data=262144 stack=65536 core=2097151 rss=65536 nofiles=2000 roles=
# lsgroup testing
testing id=203 admin=false users= registry=files
#
```

Now let's turn our attention back to the global environment. You can clearly see in
Listing 10 that the user was not created in the global environment, only within that
specific WPAR.

### Listing 10. The user was not created in the global environment

```
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] > lsuser test
3004-687 User "test" does not exist.
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] >
```

WPAR manager

It's worth noting that there is a graphical tool called WPAR manager, which is Java™
based and allows for the centralized management of WPARs (see Figure 4).

Figure 4. WPAR manager
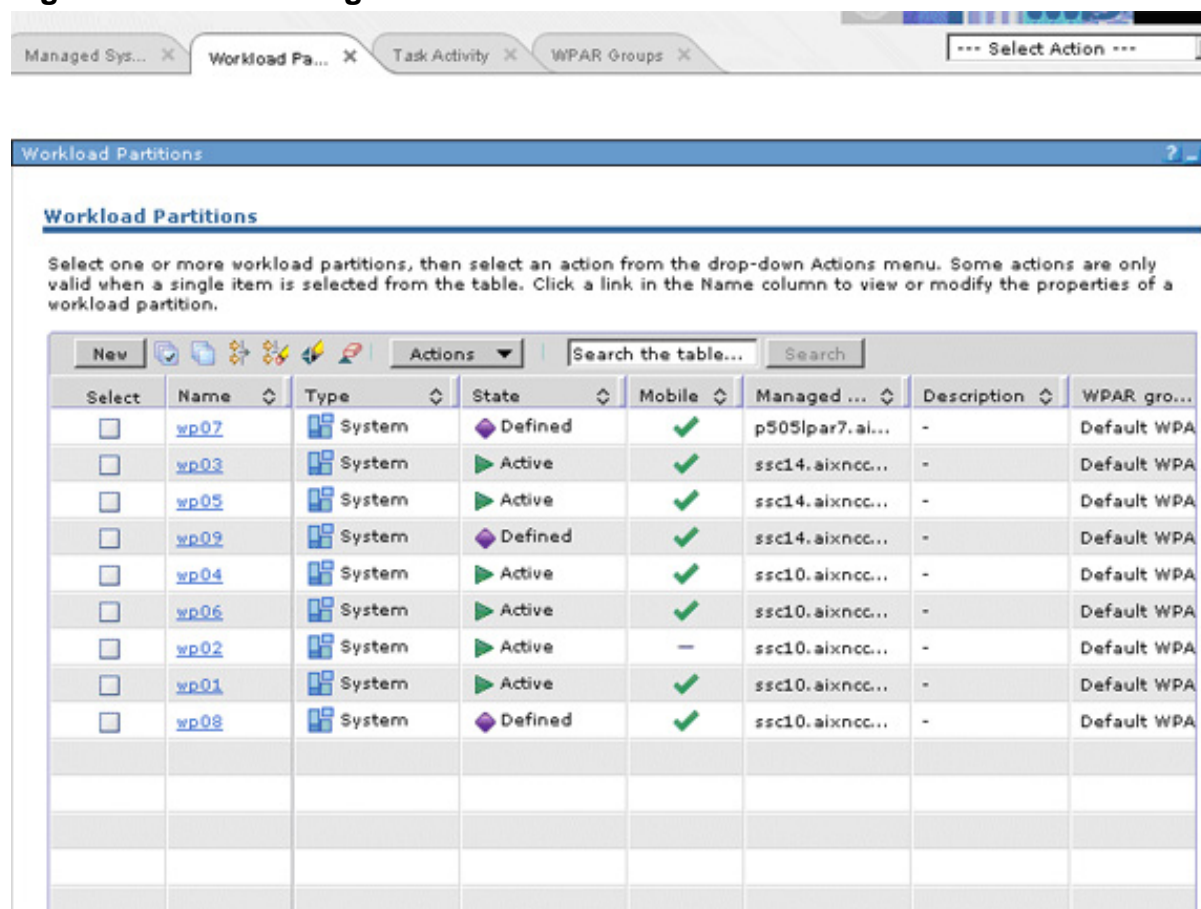
While a thorough review of this utility is outside the scope of this article, it's definitely worth looking at because using it will increase your ability to manage the overall environment. It will also help you harness innovations such as Workload Partition Manager and WPAR Mobility. Workload Partition Manager allows for resource optimization, allowing you to distribute workloads more efficiently throughout your managed system. WPAR mobility allows you to move running partitions from one frame to another, which increase availability of workloads during scheduled outages.

Application WPARs

To reiterate, an application WPAR is defined as a WPAR that allows an application and/or a process to run inside of it, similar to a wrapper. It is only temporary, not a permanent object, and it will end when the application and/or process ends. To create one, use the wparexec command.

Listing 11. Using the wparexec command to create an application WPAR

```
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] > wparexec -n templs1 /usr/bin/ls
Starting workload partition templs1.
Mounting all workload partition file systems.
```

```
Loading workload partition.
devpayrollWPAR01
Shutting down all workload partition processes.
lpar5ml162f_pub[/wpars/devpayrollWPAR01/wpars] >
```

To see how the process works while it is working, you will see the creation of the WPAR (see Listing 12).

Listing 12. Seeing the creation of the WPAR

```
 lpar5ml162f_pub[/] > lswpar
Name              State  Type  Hostname         Directory
-------------------------------------------------------------------
MyTestWpar1       A      S     MyTestWpar1      /wpars/MyTestWpar1
MyTestWpar2       A      S     MyTestWpar2      /wpars/MyTestWpar2
devpayrollWPAR01  A      S     devpayrollWPAR01 /wpars/devpayrollWPAR01
evpayrollWPAR01   D      S     evpayrollWPAR01  /wpars/evpayrollWPAR01
templs1           T      A     templs1          /
```

When the process completes, it is gone, just as fast as it was created.

Listing 13. The process is gone

```
lpar5ml162f_pub[/] > lswpar
Name              State  Type  Hostname         Directory
-------------------------------------------------------------------
MyTestWpar1       A      S     MyTestWpar1      /wpars/MyTestWpar1
MyTestWpar2       A      S     MyTestWpar2      /wpars/MyTestWpar2
devpayrollWPAR01  A      S     devpayrollWPAR01 /wpars/devpayrollWPAR01
evpayrollWPAR01   D      S     evpayrollWPAR01  /wpars/evpayrollWPAR01
lpar5ml162f_pub[/] >
```

Truthfully, although it's impressive that you can create application WPARs in a matter of seconds, and it's a feature that Solaris does not have, I think it is most useful for providing additional flexibility for testing purposes.

Summary

This article introduced WPARs and discussed the context in which to use them. The article looked at various scenarios in which WPARs should be used. It also discussed the installation, configuration, and administration of WPARs and how they relate to the global (LPAR) environment. You added users, created filesystems, and backed up WPARs. You also introduced utilities such as WPAR manager, which could be used to help manage the WPAR environment. You looked at the different types of WPARs that are available and the limitations of application WPARs compared to system WPARs. You also looked at scenarios in which WPARs may not be considered. The bottom line is that WPARs are an important innovation of AIX 6.1, and used judiciously, can increase your ability to effectively manage your system and reduce cost to the business.

Resources

Learn

- Read the Redbook Introduction to Workload Partition Management in IBM AIX Version 6.1 for detailed information on WPAR.

- For a whitepaper that introduces WPAR concepts, see AIX 6 Workload Partition and Live Application Mobility white paper introduces WPAR concepts (Mr. Thierry Fauck, III, developerWorks, September 2007).

- For a Redbook that focuses on the differences introduced in IBM AIX Version 6.1 when compared to AIX 5L Version 5.3, see IBM AIX Version 6.1 Differences Guide.

- Read Part 1 of a three-part series on AIX networking, which focuses on the challenges of optimizing network performance: Optimizing AIX 5L performance: Tuning network performance, Part 1 (Ken Milberg, developerWorks, November 2007).

- For a three-part series that focuses on the challenges of optimizing disk I/O performance, see Optimizing AIX 5L performance: Tuning disk performance, Part 1 (Ken Milberg, developerWorks, July 2007).

- For a three-part series on memory tuning on AIX, see Optimizing AIX 5L performance: Tuning your memory settings, Part 1 (Ken Milberg, developerWorks, June 2007).

- For an article that discusses the benefits of Direct I/O and tells how to implement it, see Use Direct I/O to improve performance of your AIX applications (Shiv Dutta, developerWorks, November 2002).

- Read the IBM whitepaper Improving Database Performance with AIX concurrent I/O.

- Learn about AIX memory affinity support from the IBM System p and AIX InfoCenter.

- The Redbook, Database Performance Tuning on AIX, is designed to help system designers, system administrators, and database adminsitrators design, size, implement, maintain, monitor, and tune a Relational Database Management System (RDMBS) for optimal performance on AIX.

- Get ready to take Test 234: AIX 5L Performance and Systems Tuning as part of IBM's certification program.

- Learn about IBM's Power Architecture: High-Performance Architecture with a History.

- Read Power to the People; A history of chip making at IBM (developerWorks,

December 2005) for coverage of IBM's power architecture.

- Using process affinity settings to bind or unbind threads can help you find the root cause of troublesome hang or deadlock problems. Read Processor Affinity on AIX (developerWorks, November 2006) to learn how to use processor affinity to restrict a process and run it only on a specified central processing unit (CPU).

- Read CPU Monitoring and Tuning (Wayne Huang et al. developerWorks, March, 2002) to learn how standard AIX tools can help you determine CPU bottlenecks.

- For a comprehensive guide about the performance monitoring and tuning tools that are provided with AIX 5L Version 5.3, see the IBM Redbook AIX 5L Practical Performance Tools and Tuning Guide.

- Learn what features you can benefit from in AIX 5L Version 5.3, in AIX 5L Version 5.3: What's in it for you? (developerWorks, June 2005).

- Operating System and Device Management from IBM provides users and system administrators with complete information that can affect your selection of options when performing such tasks as backing up and restoring the system, managing physical and logical storage, and sizing appropriate paging space.

- The AIX 5L Differences Guide Version 5.3 Edition (developerWorks, December 2004) redbook focuses on the differences introduced in AIX 5L Version 5.3 when compared to AIX 5L Version 5.2.

- The AIX and UNIX developerWorks zone provides a wealth of information relating to all aspects of AIX systems administration.

- New to AIX and UNIX: Visit the New to AIX and UNIX page to learn more about AIX and UNIX.

- Open source: Visit the developerWorks Open source zone for extensive how-to information, tools, and project updates to help you develop with open source technologies, and use them with IBM products.

- developerWorks technical events and webcasts: Stay current with developerWorks technical events and webcasts.

- AIX Wiki: A collaborative environment for technical information related to AIX.

- Podcasts: Tune in and catch up with IBM technical experts.

- For a comprehensive guide about the performance monitoring and tuning tools that are provided with AIX 5L Version 5.3, see the IBM Redbook AIX 5L Practical Performance Tools and Tuning Guide.

Discuss

- Participate in the AIX and UNIX forums:

- AIX 5L -- technical forum
- AIX for Developers Forum
- Cluster Systems Management
- IBM Support Assistant
- Performance Tools -- technical
- Virtualization -- technical
- More AIX and UNIX forums

About the author

Ken Milberg
Ken Milberg, PMP, is a technology writer/site expert for techtarget.com and provides Linux technical information and support at searchopensource.com. Ken is also a writer and technical editor for IBM Systems Magazine, Open Edition. Ken holds a Bachelor of Science in Computer and Information Science, as well as a Master of Science in Technology Management from the University of Maryland University College. He is the founder and group leader of the Long Island POWER-AIX users group. Through the years, he has worked for both large and small organizations and has held diverse positions from CIO to Senior AIX Engineer. Today, he works for Future Tech, a Long Island-based IBM business partner. Ken is a PMI certified Project Management Professional (PMP) and an IBM Certified Advanced Technical Expert (CATE, IBM System p5 2006).