

# Traversing Red Hat Enterprise Linux 5 on System p

## The AIX administrators' guide to learning Linux

Skill Level: Intermediate

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So you've been the IBM® AIX® guru on your team for years now and your bosses have determined that they want to try Linux® on System p™. You can fight the change, or you can embrace it and learn Linux, if not learn to love it. The purpose of this article is to introduce Linux to AIX administrators. It will show you what you need to know to make the transition to Linux simpler. It will also show you the equivalent commands to perform specific tasks and also discusses process management, filesystem management, how to peruse systems information, install packages, and other important bits of information that you as the systems administrator will need to know. While you will not become an expert at Linux from this article, this should give you a good head start in what you need to know.

## Introduction

Traversing Linux is usually a shock to most AIX administrators. While Linux is in many ways just another variant of UNIX®, in other ways it is a very different beast. For UNIX administrators who have moved to AIX from Solaris or HP-UX, you'll understand what I'm talking about. If UNIX is not always UNIX (look at the differences between Solaris, HP-UX, and AIX), how more-so will Linux not be AIX. Futhermore, with Linux, you won't have smitty to fall back on.

Generally speaking, it is easier for Solaris administrators to make the transition to Linux than AIX administrators because there are more files that need editing on both Solaris and Linux. Both Solaris and Linux are also more command-line driven than

AIX. One advantage you will have as an AIX administrator is that the hardware is the same, so if you're familiar with Virtualization using AIX on System p, you'll find a lot of similarities. If you were using Red Hat Enterprise Linux 5 (RHEL5) on an x86 box, you would be using Red Hat's Xen-based virtualization process (see [Resources](#) for more information on Xen). On System p, you'll be using the same PowerVM™ that you are using on AIX. While virtualization is outside the scope of this article, this is an important concept to understand and a big plus for you (see the [Resources](#) section for some good articles on the topic).

AIX administrators know that while their environment has a rich set of command-line tools, many of the commands will not hold without a reboot, which is one of the primary reasons for their reliance on smit. With Linux, there are many more files that have to be edited manually and, generally speaking, more commands need to be run to complete the same tasks. Red Hat also has a front end, which is a combination of various system-config-\* commands, including: system-config-display, system-config-printer, system-config-network, system-config-network, systems-config-packages, systems-config-authentication, system-config-users, and system-config-lvm. Some of them will work in text mode, and some of them will require you to get your X environment working. I strongly suggest you do so, because the GUI tools on RHEL5 add a lot of value in addition to being well designed.

While RHEL5 has a feature-rich GUI environment that you may learn to like, it is not as productive as smitty. With AIX you can use smit or smitty; you don't always have the option of going text or GUI with Linux. With Linux you also won't have the Object Data Manager (ODM), which AIX utilizes for managing devices and configuration files. With Linux, you'll rely on editing text-based files. For the purposes of this article, I'll use AIX V6.1 - TL 0 and SP2 and Red Hat Enterprise Linux Server release 5.1, with kernel Linux version 2.6.18-53.el5. Both are running on an IBM System p 570 with one CPU and 2GB RAM.

Next, you will see the tools used to get information about the system.

## Systems information

As an AIX administrator, you're probably used to running prtconf and a half-dozen or so lscfg or lsattr commands. With RHEL5, you go to /proc and cat files for this data. In AIX /proc, these files are also virtual files like in Linux, showing hardware and some settings, for example, using interprocess communications. It is used more or less for the set of 'p' commands for retrieving useful data. For example, Listing 1 shows the AIX output of one such command, pstat.

### Listing 1. Output for pstat command

```
lpar23ml16fd_pub[/] > pstat -a
PROC TABLE:

SLT ST      PID  PPID  PGRP   UID  EUID  TCNT  NAME
  0  a         0    0     0     0    0     1  swapper
      FLAGS:swapped_inno_swapfixed_prikproc 64bit
```

When you look at the directory structure for /proc on RHEL5, you'll see Listing 2.

### Listing 2. Directory structure for /proc on RHEL5

```
root@172_29_140_173 proc]# ls
1      139  1551  2712  2955  6      driver      kmsg      self
10     142  1574  2713  2956  7      execdomains loadavg   slabinfo
1015   143  170   2745  2989  8      fb          locks    stat
1016   144  1793  2746  2990  9      filesystems mdstat   swaps
1047   1447 1810  2814  3     asound    fs       meminfo   sys
1170   145  1814  2816  3031  buddyinfo ide       misc     sysrq-trigger
1174   1450 2     2817  350   bus       interrupts modules  sysvipc
1178   1462 205   284   378   cmdline  iomem    mounts    tty
1182   1486 206   2850  379   cpuinfo   ioports  net       uptime
1183   149  207   2852  380   crypto    irq      partitions version
1187   1507 208   2853  4     devices   kallsyms ppc64    vmstat
1191   151  209   2888  403   device-tree kcore    rtas     zoneinfo
1201   1549 210   2892  432   diskstats keys      schedstat
1202   1550 2710  2953  5     dma       key-users scsi
```

With AIX, you won't see all these text files to glean information from. On the RHEL5 partition, cat a file to get some information about our system. Listing 3 shows `cpuinfo`.

### Listing 3. Using `cpuinfo` to get system information

```
cd /proc[root@172_29_140_173 /]# cd /proc[root@172_29_140_173 proc]# more  cpuinfo
processor      : 0
cpu           : POWER5 (gr)
clock        : 1654.344000MHz
revision     : 2.1 (pvr 003a 0201)

processor      : 1
cpu           : POWER5 (gr)
clock        : 1654.344000MHz
revision     : 2.1 (pvr 003a 0201)

timebase     : 207050000
platform     : pSeries
machine      : CHRP IBM,9117-570
[root@172_29_140_173 proc]# \
```

Other files worth 'cating' include `meminfo`, `partitions`, `version`, and `filesystems`. Another useful Linux command is `dmesg`, as shown in Listing 4.

### Listing 4. Using `dmesg`

```
root@172_29_140_173 ~]# dmesg | more
Using pSeries machine description
Page orders: linear mapping = 24, virtual = 12, io = 12
Found initrd at 0xc0000000240000:0xc00000002679400
Partition configured for 2 cpus.
Starting Linux PPC64 #1 SMP Wed Oct 10 16:38:58 EDT 2007
-----
ppc64_pft_size           = 0x19
physicalMemorySize      = 0x80000000
ppc64_caches.dcache_line_size = 0x80
ppc64_caches.icache_line_size = 0x80
htab_address            = 0x0000000000000000
htab_hash_mask          = 0x3ffff
-----
Linux version 2.6.18-53.el5 (brewbuilder@js20-bc2-12.build.redhat.com) (gcc version 4.1.2
20070626 (Red Hat 4.1.2-14)) #1 SMP Wed Oct 10 16:38:58 EDT 2007
```

This command is similar to `prtconf` and is also used to log errors, similar to `errpt`. As you can see, there is also POWER specific information that is gleaned from the `dmesg` command.

Next, you'll see the tools needed for filesystem and Logical Volume Management (LVM).

## Filesystem and disk management

The default JFS filesystem for AIX is JFS2 and for RHEL5 it is `ext3`, which is an enhanced version of `ext2`. A new RHEL5 command is `resize2fs` (replacing `ext2onliner`), which allows one to enlarge or shrink mounted filesystems on the fly. This is supported through the Linux 2.6 kernel. It's important to note that this command does not manipulate the size of partitions, so prior to enlarging filesystem you must ensure that the underlying partition is big enough to support this. This is a similar concept to AIX where you must make sure that your volume group is large enough to support this kind of operation.

This is something else you will need to get used to. As you are aware, with AIX everything is already managed outside of the box with LVM. With Linux you'll need to work with partitions before you can configure LVM. Everything is just much more tightly integrated within AIX.

To return to RHEL5, partition information can be gleaned using `fdisk` or `parted` (see Listing 5). I prefer `parted`, as it is simpler to use.

### Listing 5. Using `parted` to get partition information

```
[root@172_29_140_173 sbin]# parted
GNU Parted 1.8.1
Using /dev/sda
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) print
```

```

Model: AIX VDASD (scsi)
Disk /dev/sda: 21.5GB
Sector size (logical/physical): 512B/512B
Partition Table: msdos

Number  Start   End     Size    Type     File system  Flags
  1      32.3kB  8225kB  8193kB  primary          boot, prep
  2      8225kB  115MB   107MB   primary  ext3
  3      115MB   19.3GB  19.2GB  primary  ext3
  4      19.3GB  21.4GB  2089MB  primary  linux-swap

```

Creating Linux filesystems can also be performed using `mkfs`, which is a front end to the `mke2fs` tool. Listing 6 shows how to create an `ext3` filesystem.

### Listing 6. Using `mkfs` to create an `ext3` filesystem

```

[root@172_29_140_173 sbin]# mkfs.ext3 /dev/sda1
mke2fs 1.39 (29-May-2006)
Filesystem label=
OS type: Linux
Block size=1024 (log=0)
Fragment size=1024 (log=0)
2000 inodes, 8000 blocks
400 blocks (5.00%) reserved for the super user
First data block=1
Maximum filesystem blocks=8388608
1 block group
8192 blocks per group, 8192 fragments per group
2000 inodes per group

Writing inode tables: done
Creating journal (1024 blocks): done
Writing superblocks and filesystem accounting information: done

```

Now try to resize the filesystem using the `resize2fs` utility referenced earlier (see Listing 7).

### Listing 7. Attempting to resize the filesystem

```

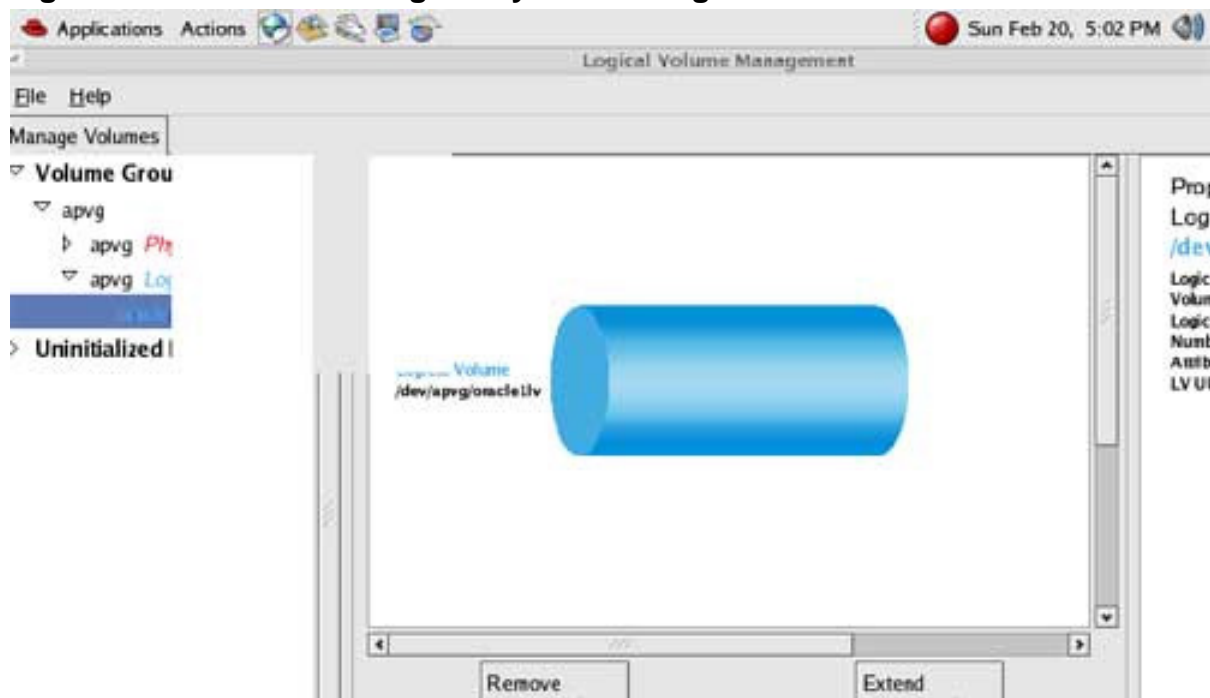
root@172_29_140_173 sbin]# resize2fs /dev/sda1 1G
resize2fs 1.39 (29-May-2006)
The containing partition (or device) is only 8001 (1k) blocks.
You requested a new size of 1048576 blocks.

```

As shown in Listing 7, it did not work because of the partition issue discussed earlier. Remember, your partition size must be able to support the new FS, similar to how with AIX you must have enough space on your volume group to increase space. Note that similar to AIX, you can now shrink an `ext3` filesystem.

## LVM

Figure 1 is a view of the RHEL5 LVM using the `system-config-lvm` tool.

**Figure 1. RHEL5 LVM using the system-config-lvm tool**

With Linux, before you can use LVM, you will need to initialize your partitions to support LVM. When that process is completed, the partition will be classified as an unallocated physical volume. From here, you can create a volume group, add to an existing volume group, or remove a volume from the LVM altogether. Command-line tools available for you include `lvcreate`, `lvremove`, and `lvextend`.

## Packages and software

This section discusses the tools needed for software installation and overall package management.

Sorry AIX brethren, but you'll have to learn to live without `lspp`. With Linux you have RPMs. Many AIX administrators already know these commands because AIX has had RPM capabilities since 5L.

Now query our systems for packages using the `-qa` flag, as shown in Listing 8.

### Listing 8. Querying our systems for packages using the `-qa` flag

```
root@172_29_140_173 sbin|# rpm -qa |more
popt-1.10.2-47.e15
pcre-6.6-1.1
libICE-1.0.1-2.1
libattr-2.4.32-1.1
libxslt-1.1.17-2
libgfortran-4.1.2-14.e15
```

```
bc-1.06-21
```

To install packages, use the `-i` flag to upgrade the `-U` flag. RPM is very powerful, but it isn't the simplest tool to learn. Make sure you take the time to learn this tool or use more sophisticated and user-friendly front ends that may be available to you. One such front end is the Yellow Dog Updated Modified (YUM). It is an interactive, automated update program that can be used for maintaining systems using RPM. RHEL4 used `up2date` package manager and RHEL5 uses YUM (see [Resources](#) for more information on YUM).

To activate daily YUM updates on a system using the `chkconfig` command (which I'll discuss in the next section), you can use this command: `[root@172_29_140_173 sbin]# /sbin/chkconfig --level 345 yum on; /sbin/service yum start.`

Next, you'll learn about the tools needed for network configuration.

## Network management

To support networking with RHEL5, you can either edit files, use the command line, use the network administration utility `system-config-network`, or use the `setup` command. Here you'll use `setup`, which is really meant for initially configuring your systems. Once you launch `setup`, you will see the Choose a Tool dialog, which contains different configuration options including Authentication, Firewall, Keyboard, Network, System services, Timezone, and X configuration.

Select **Network configuration** from this dialog to bring up the TCP/IP configuration dialog shown in Figure 2.

### Figure 2. Configure TCP/IP dialog



From here, you can set up the Network Interface Controller (NIC) with the appropriate IP information, address, netmask, gateway, and nameserver. With RHEL5 networking, you also have the standard UNIX commands you should already be accustomed to, such as `route`, the `netstat` commands, and other utilities like `ping` and `traceroute`.

Next, you'll learn about the tools needed for service management.

## Service management

AIX has the System Resource Controller and you make use of commands such as `lssrc` and `startsrc`. RHEL has various utilities including the `system-config-services` command. You can also do some of the work with the `setup` command, as referenced earlier. `Setup` actually allows one to specify which services you want to start and to bring up on boot. Other methods are to use the `service` command and the `chkconfig` command.

Use the `service` command to get a status, as shown in Listing 9.

### Listing 9. Using the `service` command

```
root@172_29_140_173 sbin]# service --status-all
amd is stopped
anacron is stopped
arpwatch is stopped
atd is stopped
auditd is stopped
automount is stopped
```

Alternatively, you can use the `chkconfig` service, which is also very handy with

scripts (see Listing 10).

### Listing 10. Using the chkconfig service

```
root@172_29_140_173 sbin]# chkconfig --list
NetworkManager 0:off 1:off 2:off 3:off 4:off 5:off 6:off
NetworkManagerDispatcher 0:off 1:off 2:off 3:off 4:off 5:off 6:off 5:off 6:off
amd 0:off 1:off 2:off 3:off 4:off 5:off 6:off
anacron 0:off 1:off 2:off 3:off 4:off 5:off 6:off
```

The text files that you can edit include `/etc/sysconfig/network-scripts`, `/etc/resolv.conf`, and `/etc/hosts`.

Now look at a table (see Table 1) that compares some of the most popular commands for AIX and RHEL5.

**Table 1. Comparing commands on AIX and RHEL5**

Type	AIX	RHEL5
Adding users	mkuser, chuser, lsuser	useradd, usermod
Adding filesystems	crfs, chfs	mke2fs, mkfs
Maintaining logical volumens	mklv, chlvs	lvcreate, lvextend, lvdisplay
Adding swap space	lspas -a	swapon -s
Managing processes	Systems resourced controller (SRC) commands	chkconfig, services, setup
System-info	prtconf more	/proc/cpuinfo, mem
Kernal paramerts	vmo, ioo, schedo, no	more /etc/sysctl.conf
Filesystem: default	jfs2	ext3
Virtualization	PowerVM	PowerVM - only on System p (Xen available in x86 versions)
GUI	smit	system-config-* commands, setup
Oslevel	oslevel -s	more redhat-release
Software	lspp	rpm, yum
Error reports	errpt	dmesg

Runlevel	who -r	runlevel
Filesystems	/etc/filesystems	/etc/fstab

## Summary

Having worked with many administrators who have transitioned to Linux from AIX, the general rule is that it is a lot easier to transition from Solaris to Linux and then AIX to Linux because Linux is more text driven and also because the text files themselves have more similar naming conventions. As an AIX administrator, you should already be very familiar with many command-line tools, which will be helpful when making the transition. While you won't find smit, you'll find enough GUI's out there to increase your comfort level.

Even though Linux has come a long way, it is simply not as mature of a product as AIX and there will be more you will need to do to document and keep your systems up and running. The good news is that today you can also sign up with IBM for a support contract with Linux, which even the most senior of AIX administrators continue to do on AIX. Linux continues to make huge inroads in terms of its reliability and scalability, particularly on the IBM System p platform. The IBM commitment to Linux is second to none in the industry, which is a huge selling point for businesses that want to start moving towards Linux.

I strongly suggest that AIX administrators receive appropriate training to ease the transition process. Don't be afraid to experiment and make mistakes. You will find that with Linux there are many more ways to accomplish the same task as with AIX. Just make sure you don't experiment in production. I always recommend that AIX administrators create a sandbox Linux partition on their System p server so that they can get a head start when the business wants to put something on the platform.

# Resources

## Learn

- [PowerVM Virtualization on IBM System p: Introduction and Configuration Fourth Edition](#): Read this Redbook for an introduction to PowerVM virtualization technologies on IBM System p servers.
- ["An Introduction to Virtualization"](#) by Amit Singh is a great introduction to virtualization and the varying implementations that are available. In addition to Linux, this article also covers other operating system virtualization (Windows, Solaris) and other means of virtualization (such as network stack virtualization)
- [Virtualization with coLinux](#) (M. Tim Jones, developerWorks, March 2007): Read an article that introduces virtualization and then looks at the approach taken by Cooperative Linux (coLinux).
- [Xen](#) is an open source virtual machine monitor (hypervisor) developed by XenSource. Xen uses what is known as paravirtualization, which typically requires guest operating system modification, but Xen can take advantage of virtualization CPUs to support unmodified guest operating systems.
- Learn about the Yellow Dog Updater Modified (YUM) program in the article [Using YUM in RHEL5 for RPM systems](#).
- [New to AIX and UNIX?](#): Visit the "New to AIX and UNIX" page to learn more about AIX and UNIX.
- [AIX Wiki](#): A collaborative environment for technical information related to AIX.
- [Optimizing AIX 5L performance: Tuning network performance, Part 1](#) (Ken Milberg, developerWorks, November 2007): Read Part 1 of a three-part series on AIX networking, which focuses on the challenges of optimizing network performance.
- 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).
- 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.
- 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.

- [CPU Monitoring and Tuning](#) (Wayne Huang et al. developerWorks, March, 2002): Read this article 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.
- [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.
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## About the author

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Ken Milberg, PMP, is a technology writer/site expert for [techtarget.com](http://techtarget.com) and provides Linux technical information and support at [searchopensource.com](http://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).