

Linux: What You Need to Know

By Richard Dolewski and Garth Tucker

MAYBE IT'S JUST ME, BUT I'M STARTING TO GET THIS FUNNY FEELING ABOUT LINUX. IT SEEMS LIKE EVERY TIME I HEAR THE WORD "LINUX," THERE IS A HUGE AMOUNT OF MEDIA ATTENTION, AND EVERYONE ALWAYS SAYS THE SAME THING: "LINUX IS NOW READY FOR PRIME TIME," OR "ENTERPRISE CUSTOMERS ARE FINALLY STARTING TO TAKE LINUX SERIOUSLY."

I want to know where this product came from. Can you call it a product if it's free? Is it really free? How can anything free be a real solution for my business? Confused? Join the crowd. Join the "paying for software" crowd. Who is paving the way for all the companies that are coming to the Linux and Open Source parties?

Linux is not new; however, many of us are new to it. A lot of us may be familiar with it on some level, either through work or because we run it at home. It has been around since 1991 when Linus Torvalds, a student at the University of Helsinki, decided to write a UNIX operating system for his PC. He did not accomplish this alone however; he reached out to others via the Internet for input into its design. He made the source code available to anyone who had the knowledge to make changes and it is still a "free" OS.

Free?

First, let's define what the **free** Linux operating system **kernel** provides.

- It manages multiple processes that may run on the system at any time.
- It schedules multiple users.
- It controls the system security.
- It controls the input and output systems of the machine, for example, printers and monitors.
- It manages the disks which are connected to the system.
- It controls access to the files on them.

How Can This Be Free?

Let's talk about "free." We often hear free in relation to Linux, and many people ask, "How can anything that's free be any good?" Before we can answer that, we need to discuss and understand how Linux is licensed.

Linux is NOT freeware or public domain; it is covered by the GNU General Public License, or GPL www.gnu.org/copyleft/copyleft.html. Now, you ask, "What is GNU GPL?" The GPL was developed by the Gnu (GNU) project www.gnu.org of the Free Software Foundation (FSF) www.fsf.org. Software covered by the GPL is copyrighted (or copylefted) to the author or authors. This means that standard international copyright laws protect the software and that the author of the software is legally defined. The GPL allows people to:

- Modify the free software, and
- Distribute their own versions of the software.

However, any works derived from GPL software must also be covered by the GPL. In other words, a company could not take Linux, modify it, and sell it under a more restrictive license. If any software is derived from Linux, that software must be covered by the GPL as well. The Free Software Foundation is a foundation dedicated to eliminating restrictions on the right of people to use, copy, modify, and redistribute computer programs.

So What Can I Get For Free?

You can download the Linux kernel free over the Internet with instructions from the Linux Web site, www.linux.org. However, the files are large and you need to work hard (*this is a relative term*) at the installation. The source code can also be downloaded and changes can be made to suit your needs, if you have the programming skills. Everybody has access to the Linux source code and volunteer software development on the Internet is common practice, with kernel development coordination by Linus Torvalds. Peer reviews play a large role in Linux development for such things as:

- Security
- Performance

The other option is through a distribution from companies such as SuSE, Red Hat, or TurboLinux. These have easier installs and contain other packaged features to make it more viable for business or personal use.

This leads to an interesting question: how do Linux distributors make money? They make money from the service offerings they have, as well as from any applications they write and market (still covered under the GPL). The first commercial distributions of Linux started appearing in 1992 and included such things as an installation program and various tools and utilities, most of which were migrated from UNIX. Commercial Linux distributions generally include:

- The kernel
- X Windows system and window managers like GNOME and KDE
- Web servers, email servers, and FTP servers
- Installation & system configuration support
- Third-party applications
- Development tools

On iSeries, Linux was announced in April, delivered in May of 2001, and runs in a partition on iSeries with V5R1 or V5R2 of OS/400. There are some restrictions as to where it can run and how much processor is required (i.e. a full or partial). We will go into a quick listing of which iSeries servers can run Linux a little further along.

This information is also readily available through IBM or from your iSeries Business Partner.

To help you make the decision on what distribution works best for your shop, check out www-1.ibm.com/servers/eserver/series/linux/dist_table.html for a great chart outlining the differences in the distributions.

What Are the Benefits of Running Linux on My iSeries?

1. Server Consolidation

Consolidation is a term that is used frequently, but is rarely put into practice due to squabbling over “turf,” mistrust of different platforms among the users or administrators of the various platforms. IBM has released statistics that indicate 60 percent of the platforms that get consolidated onto Linux are coming from Windows NT server environments, and just less than 30 percent are coming from Windows 2000 environments.

- File and Print Serving** – For print and file serving, Linux plus Samba (the Windows print and file serving clone) works as reliably as Windows itself, but without the overhead of big ticket licensing.
- Mail Serving** – Bynari is an option to consolidate your Exchange servers. It can be found on the Web at www.bynari.net. There is an overview of Bynari on the IBM site as well at www-1.ibm.com/servers/eserver/series/linux/.
- Firewall** – As a firewall, Linux provides us with NetFilter, www.netfilter.org. The netfilter/iptables project is the Linux 2.4.x / 2.5.x firewalling subsystem. It delivers you the functionality of packet filtering (stateless or stateful), all different kinds of NAT (Network Address Translation), and packet mangling.
- Application Serving** – The release of WebSphere Application Server V5.0.2 for Linux on iSeries opens the door to extend Web applications developed on other platforms to be run on Linux on iSeries. See www-1.ibm.com/servers/eserver/series/linux/websphere/index.html for

more details. These are but a few of the possible solutions available commercially; a quick search through the IBM Linux site will show you even more options.



2. Reduce Wasted Processing Horsepower

People wishing to eliminate **underutilized Intel servers** or a hardware firewall should take a look at Linux. When we say underutilized Intel servers, we are referring to the fact that you most likely had to purchase a new P4, 2 GHz server with huge amounts of memory and disk to run a single application that could quite comfortably run on a Pentium Pro 200 MHz with 128 MB of RAM and a few gigs of disk. But because it's the current PC standard, we are forced to buy much more processor than required for our applications or if the application has a peak during only part of the day when it requires that much processing and is otherwise sitting idle.

But where can we buy **new** PII 200 MHz PC servers? Nowhere that I'm aware of and so we are stuck buying the latest in PC technology which will likely be outdated before we get around to re-writing or upgrading the applications in question to take advantage of the PC horsepower we now have.

On the other hand, putting business critical applications or data on a PC from the flea market may be a career-limiting move, much like telling your boss he's not the sharpest tool in the shed – which could lead to a quick trip to the parking lot. Linux on iSeries can help you eliminate this pitfall through Dynamic Resource Movement, i.e., when you have processing power available during off hours for a particular partition, you can reassign this to another partition that requires some additional cycles.

On the iSeries, several Linux servers can be set up. In the case of the larger systems, up to 31 Linux partitions can be created and run simultaneously. This opens the door to share resources between OS/400 and Linux or between Linux partitions. With dynamic resource movement, we can move as little as 1/100th of a processor and take advantage of Virtual Storage Spaces. With processor movement, you can tune your servers for times when they have active workloads and reduce processing power when it is not required and add it elsewhere. Storage virtualization allows Linux to share storage resources (disk, tape, CD, DVD) with OS/400 and other Linux partitions, without having to physically add another drive as you would likely have to do with a PC solution.



3. Total Cost of Ownership

In my opinion, this is open for debate due to the fact that Linux is still relatively new to the iSeries and solid Total Cost of Ownership numbers are not readily available. However, there are tools, such as TCOnow! from CIOview. They are an independent TCO tool vendor, so their TCOnow! tools are based on independent data from IT experts, and can help you understand the full financial impact of your IT purchase decisions over a three, four or five year period.

4. IBM's Backing



On the highest level, what would lead me to look at Linux on iSeries would be IBM's investment to support Linux on iSeries, which means support will be readily available through 1-800-IBM-SERV, Business Partners as well as from your Linux distributor. According to statistics compiled by Gartner's Dataquest research unit, IBM captured 41.6 percent of the \$385 million in Linux server sales in the U.S. market alone last year. So we know the Big Blue Machine is in our corner when we decide to move onto Linux.

5. New Development Paradigms

Linux on your iSeries will allow you to take advantage of a new generation of applications, thus enhancing iSeries flexibility, by enabling another application environment. Also, it doesn't hurt that you get to brag that your shop is using leading edge technology. The iSeries is now able to capitalize on the open source movement, leverage the Linux virtual worldwide development team and when a 400 shop includes Linux in its repertoire, it is encouraging a broader skill base to deliver iSeries based solutions. Linux to OS/400 application integration can utilize such tools as ODBC and JDBC to provide access to DB2/400 or Samba and NFS for file access.

A recent IBM survey across companies in the Western economies found that about 65 percent of businesses are using Linux for Web serving, with another 50 percent using it for network serving, another 50 percent using it for Web appliances, and nearly another 50 percent using it for firewalls. Yet another 45 percent use it for application development, and another 40 percent use it for email serving. A small number of customers are using Linux for e-commerce, workgroup, technical applications, data warehousing, or other things.

This will change as Linux gains a reputation for reliability on the iSeries and you will see more and more applications ported to run on Linux. With iSeries providing a 64 bit environment to run in, it makes sense that companies will want to take advantage of that extra processing power.

6. Storage Area Network facilities

iSeries provides SAN facilities for the Linux partitions' full OS/400 system backup. It provides DR for Linux, and daily backups performed by Linux support file level save/restore. Linux also utilizes iSeries tape devices for backup operations. iSeries protects the disks via RAID, when adding, moving, and deleting disk space for Linux. It manages OS/400 & Linux disks from one system. Linux partitions are able to access disk, tape, CD-ROM, and DVD resources in OS/400 partitions. With Virtual I/O, Linux is able to leverage the performance availability, and manageability of the advanced iSeries storage architecture.

The Good and the Bad News

This is not to say that Linux will someday take over everything. There will always be a place for "Best of Breed" software, and Linux's use of open protocols means its advantage is always in ease of use, never in locking out the competition. Face it: it's a Windows world. Whether you use Linux on your home system or at your job, the chances are that you have to work with Windows users and their systems, and – more important – that you exchange data with them on a regular basis. The trick will be to turn them into Linux users. Linux and Open Source are becoming inevitable forces in the world of IT. Personally, I would have never believed it. Then again neither did IBM.

Installing Linux

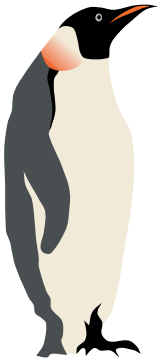
Okay, so now you're hooked on Linux from our amazing sales pitch and want to know how to do it. Call us, we're available at a reasonable daily rate and will even let you buy us lunch.

No sale? Okay, so here's a 10,000-foot view of getting Linux onto your iSeries. We are not going to re-print all the steps to follow from the manual, but will give you the major steps and you can decide if you're comfortable enough to dig deeper and DIY.

Linux has many applications available to be installed "right out of the box" with your preferred distribution. Before starting the install, you should determine what applications you require so that when you reach the point where you are prompted, you know exactly which selections to make.

Can My iSeries Run Linux?

If you have one of the following iSeries servers, chances are you can configure a Linux partition:



- 270
- 800
- 810
- 820
- 825
- 830
- 870
- 890

There may be some restrictions as to how much of a processor is required, but that information is readily available.

It runs in a partition, so you must dust off your LPAR skills and configure a partition to support Linux as either virtual or direct. You must determine what amounts of disk, memory, processor, and

other assorted hardware your partition or partitions should have. A good planning session with IBM or your Business Partner is recommended.

Virtual? Direct? What's the Difference?

In a virtual Linux partition, the hardware is owned by OS/400 and shared to Linux. OS/400 lets Linux have the illusion that it's in charge while actually controlling things from behind the scenes. Virtual I/O devices supported include: disk, tape, CD-ROM, and DVD. Disk space is owned by OS/400 and is reserved for Linux. A Network Storage Space is defined and associated with a given NWSD. In the direct paradigm, Linux actually controls the devices. OS/400 does not see the devices and cannot directly use them. Specific iSeries I/O adapters are supported in Direct I/O environment. Specific Ultra SCSI Adapters for Disk, Tape, CD-ROM, and DVD connections are supported.

In addition, selected iSeries Ethernet and Token Ring adapters are also supported. These are also referred to as Hosted (Virtual) and Non-hosted (Direct), but are the same thing.

Next, we must create a network server description (NWSD) and network server storage space (NWSSTG). To create the NWSD, use the Create Network Server Description (CRTNWSD) command. This gives us our server description that can be varied on and off (started and stopped), but does not give us any disk space. To accomplish this, we must configure a network server storage space (NWSSTG). This is a stream file in the IFS that look like a local hard drive to the server and you may configure several. These can contain the kernel and boot images or be linked on OS/400 and mounted as a separate partition or partitions to contain user data.

After creating our server storage space, we link it to our network server description so that it has parameters

About the Authors

Garth Tucker is an iSeries Technical Specialist. He is IBM Certified in Technical Solutions, Sales and Linux for iSeries with OS/400 versions V4R3 through V5R2.

Garth has many years of experience with AS/400 and iSeries. His specialties include Back-Up, Recovery and Media Services, Linux, Operations Navigator/Management Central, Educational Services and Disaster Recovery as well as experience with Help Systems Robot products.

Garth has helped write the Technical Overviews of V4R4, V4R5 and V5R1 with IBM/ITSO in Rochester, Minnesota, and has traveled extensively throughout North America, Europe, the Middle East and Africa teaching both Technical Solutions and Sales Solutions for iSeries (Shark Camp) as well as Linux for IBM. In addition, he has written articles for the Toronto User Group Magazine, Midrange Magazine as well as presenting at COMMON. He can be reached at 905-940-1814 or via email at garth@midrange.ca.



Richard Dolewski is a certified systems integration specialist and disaster recovery planner. As a Managing Director of the technical and contingency services provided by Mid-Range Technical Services, he has extensive experience in Disaster Recovery Planning, Backup & Recovery program design, and Server consolidation.

Richard has implemented a variety of IBM iSeries solutions for customers in Canada, the U.S. & Mexico. He has supported multiple computer room disasters, and conducted over 120 disaster recovery tests. Richard



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to control its usage. In the case that the server is booting from a network server storage space, it should be the first drive linked.

Where Do I Log On?

On iSeries, Linux utilizes a virtual console to access the Linux partition to do the initial installation, diagnostic searches for messages or to access Linux if you can't access it from the network. The virtual console is a Telnet program, such as PuTTY, running in the low level code below the operating system listening for requests on port 2301 of the hosting partition or the primary partition.

Unlike the IXS or IXA, there is no directly attached PC hardware used as the console. In order to sign on to the console, you must configure a service tools (SST) user ID, through DST, with the appropriate privileges. This should be done at the time you are creating your partition.

Are We There Yet?

Now you have the necessary blocks to build your Linux server and the CD is in the drive and the NWSD has been configured to boot from it (or an image catalogue – but that's a whole other article). You issue the VRYCFG command against your NWSD and the Linux install program takes over from here. All that remains is to install the application software that you have determined you require.

We Are There!

Now you have your Linux partition installed and configured. Welcome to the most dynamic operating system available today. Keep current with what's happening with Linux, as there are updates, changes, and new applications becoming available each and every day. Some good sites to take a regular pass through are:

www.linux.org
www.ibm.com/linux
www.suse.com
www.redhat.com
www.linuxhq.com
www.linuxfund.org
www.tsanet.org
www.linux-support.net/



Torvalds Announces Release 2.6.0 of Linux Kernel

The previous production version (2.4) of the Linux kernel was released three years ago, but contributors are still making patches to it. So Torvalds' December 24th announcement that version 2.6.0 is ready for "general field release" is perhaps a mere formality. Nevertheless, readers of the linux-kernel mailing list were delighted to read his message declaring that the test phase is complete.

"The Beaver is Out of Detox"

...said **Linus Torvalds**, referring to the latest core release. "The patch from test11 is a svelte 11KB in size," he wrote. "It's not the totally empty patch I was hoping for, but judging by the bugs I worked on personally, things are looking pretty good!" Of the remaining defects, most are "not considered to be release-critical," Torvalds went on to say. Starting with the first test version last July, there have been numerous updates, with each one significantly cleaner than the previous. He finally decided that it was OK-4-GO!

Performance Characteristics

Kernel maintainer **Andrew Morton** added, "Version 2.6 should run well on most servers, although large database applications will experience performance problems. Fixes have already been found for some of these, and will be introduced in version 2.6.1 of the kernel."

He went on to say that by changing the default behavior of the kernel's I/O scheduler, even the performance of these large database applications can be improved. Morton was quoted as saying, "Desktop and laptop users may still see some bugs, as the variety of available hardware in such machines makes testing more difficult."

Not all machines capable of running Linux enjoy the 64-bit architecture of the iSeries. The main distributors of Linux on the iSeries are Red Hat, SuSe, and Turbolinux, (plus the UnitedLinux consortium).

iSeries Progress

Of course this is a very dynamic environment, with new patches coming out regularly, so these versions are probably obsolete by press time. Currently, the SuSE Linux Developer Edition 7.1 is shipped with a patched 2.4.3 kernel, which was made by IBM specifically for the iSeries.

Red Hat's newest release, Red Hat Enterprise Linux 3, supports all IBM server platforms including iSeries. Enhancements include support for the 2.4.21 kernel, a complete 64-bit implementation.

Turbolinux Enterprise Server 8 for IBM zSeries, iSeries and pSeries systems is based on kernel 2.4.3, and Version 1.0 from UnitedLinux (a consortium of various Linux vendors to create a single worldwide Linux distribution) was based on kernel 2.4.19, but has since been upgraded.

Although the newly announced Linux kernel version 2.6 includes support for many low-cost, low-power processors with limited memory management capabilities, it has been tested on servers with up to 64 processors, and supports up to 64GB of memory on 32-bit systems. It will be really interesting to see how well it does in the iSeries 64-bit environment!

For the latest developments regarding Linux on the iSeries, start with this Web site... <http://www-124.ibm.com/developerworks/oss/linux/>.

– Editor