Linux System Administration-I CSE-4043

Chapter 1 : Where to Start

Nibedita Jagadev

Assistant Professor
Department of Computer Science and Engineering
SOA University, Bhubaneswar, Odisha, India
Email: nibeditajagadev@soa.ac.in

Introduction

- What is an Operating System
- Types of Operating Systems
- UNIX Operating System
- Uses of Unix
- Unix Kernel
- Suggested Background
- Essential Duties of System Administrator.

What is an Operating System

Operating System is an interface between a computer user and computer hardware.

OS is a software which performs all the basic tasks like file management, memory management, process management, handling input output devices etc.

System Resources
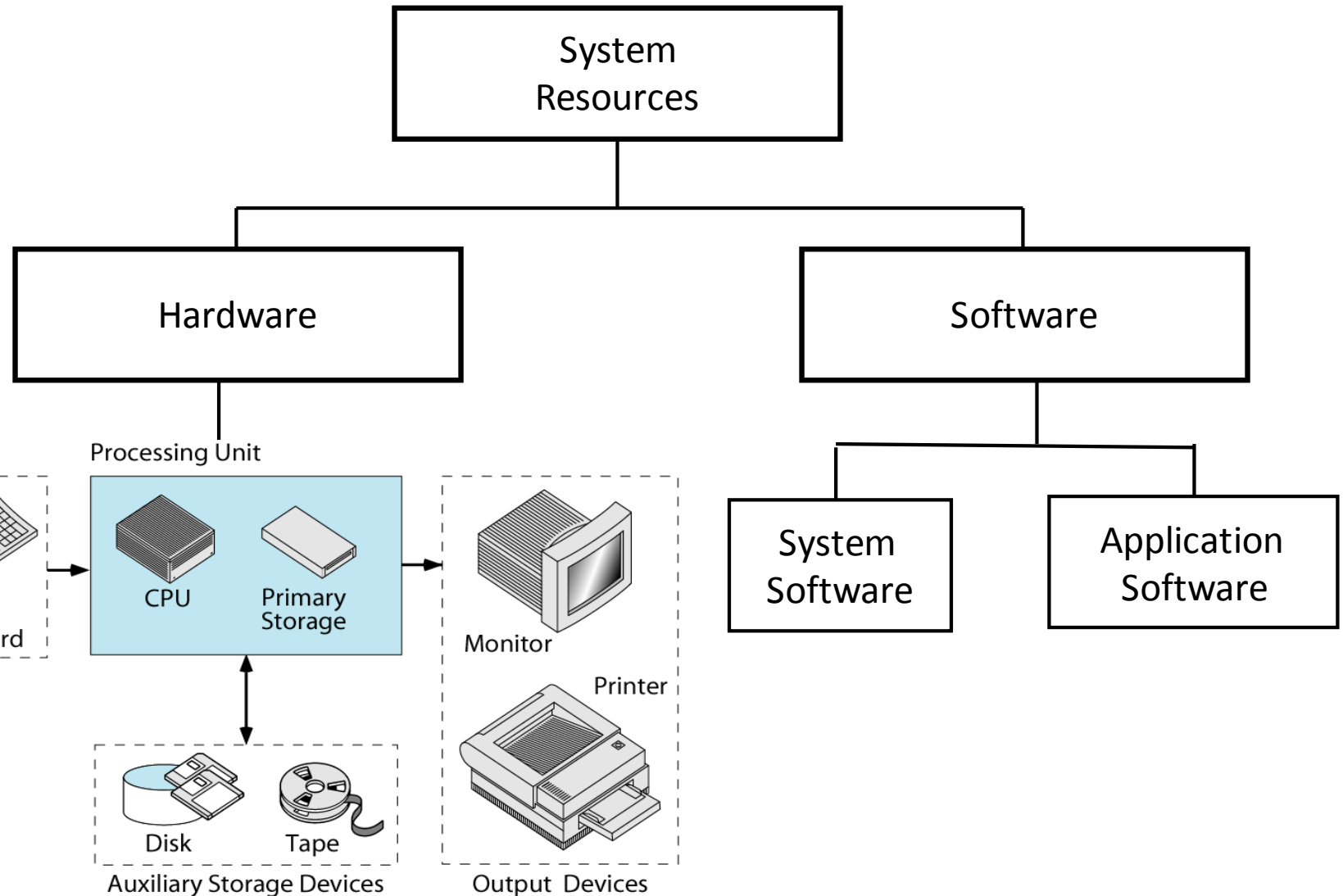
Types of Operating Systems

- Single-user, single-process operating systems:
  - allow only one user at a time on the computer system
  - user can execute/run only one process at a time

  Examples: DOS, Windows 3.1

- Single-user, multi-process operating systems:
  - allow a single user to use the computer system
  - user can run multiple processes at the same time

  Example: OS/2

Types of Operating Systems

- Multi-user, multi-process operating systems:

  - allow multiple users to use the computer system simultaneously

  - Each user can run multiple processes at the same time

  Examples: UNIX, Windows NT (2000, XP, Vista)

UNIX Operating System

- UNIX is an Operating System

  – Software that manages (allocates and de-allocates) system resources in an efficient and secure manner

  – Unix OS is a set of programs that act as a link between the computer and the user.

UNIX Operating System

- Invented by Ken Thompson at AT&T in 1969
- First version written in assembly language
  - single user system, no network capability
- Thompson, Dennis Ritchie, Brian Kernighan
  - rewrote Unix in C: processor/architecture independent
- Unix evolution:
  - Bell Labs, USL, Novell, SCO
  - BSD, FreeBSD, Mach, OS X
  - AIX (IBM), Ultrix, Irix, Solaris (Sun), …
  - Linux: Linus Torvalds

USES OF UNIX

User Support Tools
    Text processing (vi, sed, awk)
    Productivity applications
Programmer Support Tools
    Programming languages & compilers (C, C++, Java)
Shell scripts
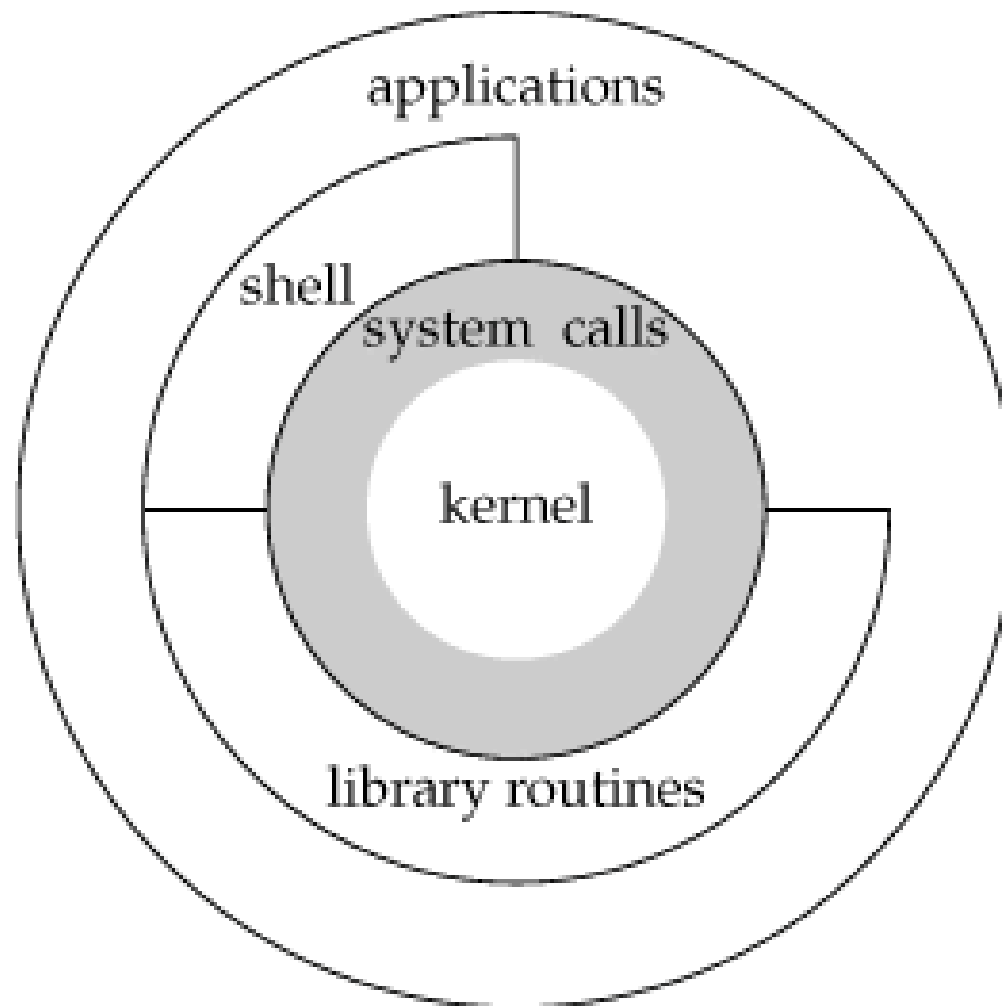   Personal software process: version control
        Source Code Control System (SCCS)
        Revision Control System (RCS)
Unix as server
    Web server, mail server, application server

Unix Kernel

Suggested Background

- You should have a certain amount of Linux or UNIX experience. In particular, you should have a general concept of how the system looks and feels from the user's perspective.

- Your editor can be a GUI tool like **gedit or a command-line tool such as vi or emacs. Word processors such as Microsoft Word and OpenOffice Writer are quite** different from text editors and are nearly useless for administrative tasks. Command-line tools have an edge because they can run over simple SSH connections and on ailing systems that won't boot; there's no need for a window system. They are also much faster for the quick little edits that administrators often need

- For new scripting projects, Perl or Python is recommend. As a programming language, Perl is admittedly a bit strange. However, it does include many features that are indispensable for administrators. The O'Reilly book *Programming Perl by* Larry Wall et al. is the standard text; it's also a model of good technical writing.

Essential Duties of the System Administrator

- Account provisioning
- Adding and removing hardware
- Performing backups
- Installing and upgrading software
- Monitoring the system
- Troubleshooting
- Maintaining local documentation
- Vigilantly monitoring security
- Fire fighting

Account Provisioning

- The system administrator adds accounts for new users, removes the accounts of users that are no longer active.

- Handles all the account-related issues that (e.g., forgotten passwords).

- Come up in between (e.g., forgotten passwords).

- The process of adding and removing users

- When a user should no longer have access to the system, the user's account must be disabled. All the files owned by the account should be backed up and then disposed of so that the system does not accumulate unwanted baggage over time

Adding and Removing Hardware

- When new hardware is purchased or when hardware is moved from one machine to another, the system must be configured to recognize and use that hardware.

Performing Backups

- Performing backups is perhaps the most important job of the system administrator.

- Backups are time consuming but they are absolutely necessary.

- Backups can be automated but it is still the system administrator's job to make sure that backups are executed correctly and on schedule (and that

- The resulting media can actually be used to restore files).

Installing and upgrading software

- When new software is acquired, it must be installed and tested, often under several operating systems and on several types of hardware.

- Once the software is working correctly, users must be informed of its availability and location.

- As this software evolves, new releases should be staged for testing before being deployed to the entire site.

Monitoring the System

- Regularly ensure that email and web services are working correctly

- Watch log files for early signs of trouble, make sure that local networks are properly connected, and keep an eye on the availability of system resources such as disk space

Troubleshooting

- System failures are inevitable.

- It is the administrator's job to play as a mechanic by diagnosing problems and calling in experts if needed.

- Finding the problem is often harder than fixing it.

Maintaining Local Documentation

- As a system is changed to suit an organization's needs, it begins to differ according to the need.

- System administrator is responsible for making these customizations, it's also the sys admin's duty to document the changes.

Vigilantly Monitoring Security

- The system administrator must implement a security policy and periodically check to be sure that the security of the system has not been violated.

Fire Fighting

- Although helping users with their various problems is rarely included in a system administrator's job description. It claims a significant portion of most administrators' workdays

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- **Friction Between Unix** and **Linux**
- Linux Distributions
- Unix Distributions
- Units
- Man Pages
- Other On-line Documentation

Friction Between Unix and Linux

- Unfortunately, mentioning UNIX and Linux together in the same sentence can sometimes be like stepping into a political minefield, or perhaps blundering into a large patch of quicksand. But since the relationship between UNIX and Linux seems to engender some confusion as well as animosity, it's hard to avoid staking out a position. Here is our perspective and our short version of the facts.

- Linux is a reimplementation and elaboration of the UNIX kernel. It conforms to the POSIX standard, runs on several hardware platforms, and is compatible with most existing UNIX software. It differs from many—but not all—variants of UNIX in that it is free, open source, and cooperatively developed. Linux includes technical advances that did not exist in UNIX, so it is more than just a UNIX clone. At the same time, traditional UNIX vendors have continued to refine their systems, so there are certainly areas in which commercial UNIX systems are superior to Linux.

Friction Between Unix and Linux

- Whatever the relative merits of the systems, Linux is a legally, developmentally, and historically distinct entity that cannot properly be referred to as "UNIX" or as a "version of UNIX." To do so is to slight the work and innovation of the Linux community. At the same time, it's somewhat misleading to insist that Linux is "not UNIX."

- Linux software is UNIX software. Thanks largely to the GNU Project, most of the important software that gives UNIX systems their value has been developed under some form of open source model. The same code runs on Linux and non-Linux systems. The Apache web server, for example, doesn't much care whether it's running on Linux or Solaris. From the standpoint of applications and most administrative software, Linux is simply one of the best-supported and most widely available varieties of UNIX.

Friction Between Unix and Linux

- It's also worth noting that Linux is not the only free UNIX-like operating system in the world. OpenSolaris is free and open source, although its exact licensing terms have earned suspicious looks from some open source purists. FreeBSD, NetBSD, and OpenBSD—all offshoots of the Berkeley Software Distribution from UC Berkeley—have ardent followers of their own. These OSes are generally comparable to Linux in their features and reliability, although.

Linux Distributions

- All Linux distributions share the same kernel lineage, but the ancillary materials that go along with that kernel can vary quite a bit. Distributions vary in their focus, support, and popularity. There continue to be hundreds of independent Linux distributions, but our sense is that distributions based on the Debian, Red Hat, and SUSE lineages will continue to predominate in production environments over the next five years.

- Here we consider the management of large-scale installations, we're partial to distributions such as Red Hat Enterprise Linux that take into account the management of networks of machines. Some distributions are designed with production environments in mind, and others are not. The extra crumbs of assistance that the production-oriented systems toss out can make a significant difference in ease of administration.

Linux Distributions

- Some important questions to ask are
- Is this distribution going to be around in five years?
- Is this distribution going to stay on top of the latest security patches?
- Is this distribution going to release updated software promptly?
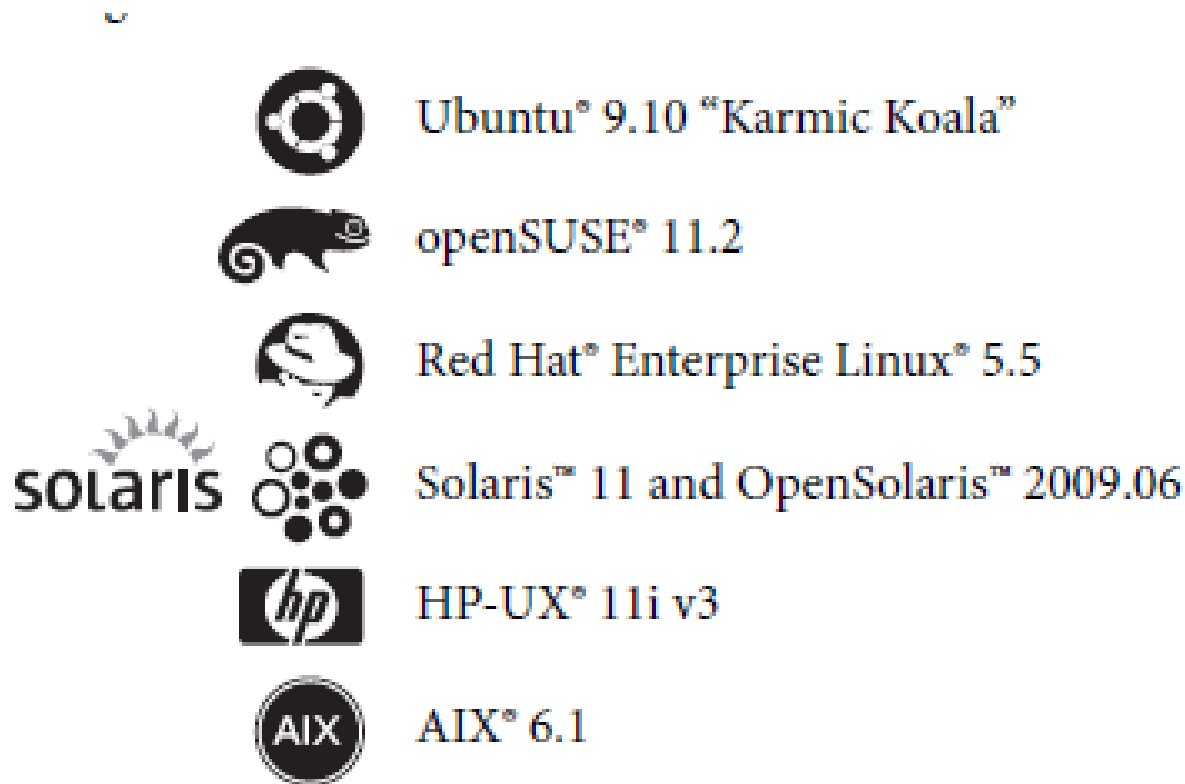- If I have problems, will the vendor talk to me?

Viewed in this light, some of the more interesting, offbeat distributions don't sound quite so appealing. But don't count them out: E*Trade, for example, runs on Gentoo Linux.

Linux Distributions

Table 1.1   **Most popular general-purpose Linux distributions**

Distribution	Web site	Comments
CentOS	centos.org	Free analog of Red Hat Enterprise
Debian	debian.org	Closest to GNU
Fedora	fedoraproject.org	De-corporatized Red Hat Linux
Gentoo	gentoo.org	Compile-it-yourself, optimized
Linux Mint	linuxmint.com	Ubuntu-based, elegant apps
Mandriva	mandriva.com	Long history, "easy to try"
openSUSE	opensuse.org	Free analog of SUSE Linux Enterprise
Oracle Enterprise Linux	oracle.com	Oracle-supported version of RHEL
PCLinuxOS	pclinuxos.com	Fork of Mandriva, KDE-oriented
Red Flag	redflag-linux.com	Chinese distro, similar to Red Hat
Red Hat Enterprise	redhat.com	Reliable, slow-changing, commercial
Slackware	slackware.com	Grizzled, long-surviving distro
SUSE Linux Enterprise	novell.com/linux	Strong in Europe, multilingual
Ubuntu	ubuntu.com	Cleaned-up version of Debian

Linux Distributions

Ubuntu® 9.10 "Karmic Koala"

openSUSE® 11.2

Red Hat® Enterprise Linux® 5.5

Solaris™ 11 and OpenSolaris™ 2009.06

HP-UX® 11i v3

AIX® 6.1

These logos are used with the kind permission of their respective owners. However, the vendors have not reviewed or endorsed the contents of this book. The paragraphs below provide a bit more detail about each of these example systems.

Linux Distributions

Example Linux distributions

Information that's specific to Linux but not to any particular distribution is marked with the Tux penguin logo shown at left.

The Ubuntu distributions maintain an ideological commitment to community development and open access, so there's never any question about which parts of the distribution are free or redistributable. Ubuntu currently enjoys philanthropic funding from South African entrepreneur Mark Shuttleworth.

Ubuntu is based on the Debian distribution and uses Debian's packaging system. It comes in two main forms, a Desktop Edition and a Server Edition. They are essentially similar, but the Server Edition kernel comes pretuned for server use and does not install a GUI or GUI applications such as OpenOffice.

SUSE, now part of Novell, has taken the path of Red Hat and forked into two related distributions: one (openSUSE) that contains only free software; and another (SUSE Linux Enterprise) that costs money, includes a formal support path, and offers a few extra trinkets. Nothing in this book is specific to one SUSE distribution or the other, so we simply refer to them collectively as "SUSE."

Red Hat has been a dominant force in the Linux world for most of the last decade, and its distributions are widely used in North America. In 2003, the original Red Hat Linux distribution was split into a production-centered line called Red Hat Enterprise Linux (which we refer to as RHEL or Red Hat in this book) and a

Unix Distributions

Example UNIX distributions

solaris Solaris is a System V derivative with many extensions from the company formerly known as Sun Microsystems, now part of Oracle.[5] Sun UNIX (as it was called in the mid-80s) was originally the progeny of Berkeley UNIX, but a (now historic) corporate partnership between Sun and AT&T forced a change of code base. Solaris runs on a variety of hardware platforms, most notably Intel x86 and SPARC.

In Sun's hands, Solaris was free to download and use. However, Oracle has changed this policy, and current downloads are labeled as 90-day free trial editions. The existence of OpenSolaris, an explicitly free and open source version of Solaris, complicates the picture as well. At this point (mid-2010), Oracle's exact plans for Solaris and OpenSolaris remain unclear.

The release of Solaris 11 is expected some time this year, and every indication so far is that it will hew closely to OpenSolaris. In this book, the composite system we refer to as "Solaris" is based on production Solaris 10 and OpenSolaris releases, adjusted with guidance from our network of deep-cover spies within Oracle. In a few cases, we note specifics for Solaris 10 or OpenSolaris.

hp HP-UX is based on System V and is tied to Hewlett-Packard's hardware platforms. It's closer to the ancestral source tree than either Solaris or AIX, but HP has kept pace with developments in the OS world and has added a variety of its own enhancements. Now that HP has begun supporting Linux as well, the future of HP-UX is somewhat less clear.

Unix Distributions

IBM's AIX started as a variant of Berkeley's 4.2BSD, but as of version 4 in 1994, most parts of the system migrated to System V. At this point, AIX has drifted rather far from both origins.

In general, we have the impression that AIX has enjoyed less cross-pollination from other systems than most UNIX variants. It also seems to have fallen under the Svengali-like influence of some of IBM's mainframe and AS/400 operating systems, from which it inherits conventions such as the Object Data Manager (see page 432), the use of configuration commands rather than configuration files, and the SMIT administrative interface. Over time, one might charitably say, it has grown to be more and more like itself.

IBM has been pursuing an interestingly OS-agnostic approach to marketing its hardware for most of the last decade. IBM continues to develop and promote AIX, but it's also engaged in partnerships with Red Hat and Novell to ensure that their respective Linux distributions run smoothly on IBM hardware. It will be interesting to see how this approach plays out in the years ahead.

Units

Table 1.2   Unit decoding examples

Example	Meaning
56 kb/s serial line	A serial line that transmits 56,000 bits per second
1kB file	A file that contains 1,000 bytes
4KiB SSD pages	SSD pages that contain 4,096 bytes
8KB of memory	Not used in this book; see note below
100MB file size limit	Nominally 10^8 bytes; in context, ambiguous
100MB disk partition	Nominally 10^8 bytes; in context, probably 99,999,744 bytes[a]
1GiB of RAM	Exactly 1,073,741,824 bytes of memory[b]
1 Gb/s Ethernet	A network that transmits 1,000,000,000 bits per second
1TB hard disk	A hard disk that stores 1,000,000,000,000 bytes

a. That is, 10^8 rounded down to the nearest whole multiple of the disk's 512-byte block size
b. But according to Microsoft, still not enough memory to run the 64-bit version of Windows 7

Man Pages and Other On−line Documentation

- The manual pages, usually called "man pages" because they are read with the **man** command, constitute the traditional "on-line" documentation. (Of course, these days all the documentation is on-line in some form or another.) Man pages are typically installed with the system. Program-specific man pages come along for the ride when you install new software packages.

Organization of the man pages

- All systems divide the man pages into sections, but there are minor variations in the way some sections are defined. The basic schema used by our example systems is shown in Table 1.3.

Man Pages and Other On-line Documentation

Table 1.3 Sections of the man pages

Linux	Solaris	HP-UX	AIX	Contents
1	1	1	1	User-level commands and applications
2	2	2	2	System calls and kernel error codes
3	3	3	3	Library calls
4	7	7	4	Device drivers and network protocols
5	4	4	5	Standard file formats
6	6	–	6	Games and demonstrations
7	5	5	7	Miscellaneous files and documents
8	1m	1m	8	System administration commands
9	9	–	–	Obscure kernel specs and interfaces
–	–	9	–	HP-UX general information

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- Other Authoritative Documentation
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Other Authoritative Documentation

- **System-specific guides**

  Major vendors have their own dedicated documentation projects, and many continue to produce useful book-length manuals. These days the manuals are usually found on-line rather than in the form of printed books. The extent and quality of the documentation vary widely, but most vendors produce at least an administration guide and an installation guide. Table 1.4 shows where to look for each of our example systems.

Table 1.4 Where to find OS vendors' proprietary documentation

System	URL	Comments
Ubuntu	help.ubuntu.com	Mostly user-oriented; see "server guide"
SUSE	novell.com/documentation	Admin stuff is in "reference guide"
RHEL	redhat.com/docs	Mostly documents Red Hat extensions
Solaris	docs.sun.com	Extensive catalog of materials
HP-UX	docs.hp.com	Books, white papers, and tech guides
AIX	www.redbooks.ibm.com	Numerous real books in PDF format
	ibm.com/support	Support gateway to notes, FAQs, etc.

Authoritative Documentation

- Most of the important software packages in the UNIX and Linux world are maintained by individuals or by third parties such as the Internet Systems Consortium and the Apache Software Foundation. These groups write their own documentation. The quality differs from embarrassing to spectacular, but jewels such as *Version Control with Subversion from svnbook.red-bean.com make the* hunt worthwhile.

Authoritative Documentation

- UNIX vendors and Linux distributors always include the appropriate man pages in their packages. Unfortunately, they tend to skip on other documentation, mostly because there really isn't a standard place to put it (check **/usr/share/doc).** It's often useful to check the original source of the software to see if additional materials are available.

Authoritative Documentation

RFCs and other Internet documents

- The Request for Comments document series describes the protocols and procedures used on the Internet. Most of these documents are relatively detailed and technical, but some are written as overviews. They are absolutely authoritative, and many are quite useful for system administrators.

Authoritative Documentation

The Linux Documentation Project

- Linux systems have another major source of reference information: the Linux Documentation Project at tldp.org. This site hosts a huge array of user-contributed documentation ranging from FAQs to full-length guides. The LDP also centralizes efforts to translate Linux-related documents into additional languages. Unfortunately, many of the LDP documents are not well maintained. Since Linux years are different in their relation to real time, untended documents are apt to go out of date quickly. Always check the time stamp on a HOWTO or guide and weigh its credibility accordingly.

Other Sources of Information

- It should go without saying, but Google is a system administrator's best friend. Unless you're looking up the details of a specific command or file format, Google should be the first resource you consult for any sys admin question. Make it a habit; if nothing else, you'll avoid the delay and humiliation of having your questions in an on-line forum answered with a link to Google. *When stuck, Google.*

- We can't enumerate every useful collection of UNIX and Linux information on the Internet, but a few of the most significant ones are shown in Table 1.5.

Other Sources of Information

Table 1.5 Sysadmin resources on the web

Web site	Description
blogs.sun.com	Great collection of technical articles, many Solaris-related
cpan.org	Authoritative collection of Perl modules
freshmeat.net	Large index of Linux and UNIX software
kernel.org	Official Linux kernel site
linux.com	Linux forum, good for new users[a]
linux.org	General Linux information clearing house
linux.slashdot.org	Linux-specific arm of tech news giant Slashdot
linuxhq.com	Compilation of kernel-related info and patches
lwn.net	Linux and open source news service
lxer.com	Linux news aggregator
rootvg.net	AIX-oriented site with lots of links and good forums
securityfocus.com	General computer security info
serverfault.com	Collaboratively edited database of sysadmin questions
ServerFiles.com	Directory of network admin software and hardware
slashdot.org	Tech news in a variety of categories
solariscentral.org	Open blog with Solaris-related news and articles
sun.com/bigadmin	Sun-specific aggregation site for admin info
sunhelp.org	Very nice collection of Sun-related material
ugu.com	UNIX Guru Universe – all things sysadmin

a. This site is now run by the Linux Foundation.

System Administration Under Pressure

- System administrators wear many hats. In the real world, they are often people with other jobs who have been asked to look after a few computers on the side. If this is your situation, tread carefully and be aware of how this scenario tends to play out over the long term.

- The more experienced you become at system management, the more the user community comes to depend on you. Networks invariably grow, and administrative work tends to accumulate over time as your administration system becomes more sophisticated and you add additional layers. You will soon find that you are the only person in your organization who knows how to perform a variety of important tasks.

System Administration Under Pressure

- Once coworkers come to think of you as the local system administrator, it is difficult to extricate yourself from this role. That is not necessarily a bad thing, but we know several people who have changed jobs to escape it. Since many administrative tasks are intangible, you may also find that you're expected to be both a fulltime administrator and a full-time engineer, writer, or analyst.

- There is a common tendency for unwilling administrators to fend off requests by adopting a surly attitude and providing poor service. This approach usually backfires; it makes you look bad and creates additional problems.

System Administration Under Pressure

- Instead, consider keeping detailed records of the time you spend on system administration. Your goal should be to keep the work at a manageable level and to assemble evidence that you can use when you ask to be relieved of administrative duties.

- On the other hand, you may find that you enjoy system administration and that you prefer it to real work.

Thank you