

**Internet System
Management
Academic Student Guide**



EVALUATION COPY

Internet System Management

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ISBN: 1-58143-614-9



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Course Description

Internet System Management is a course designed to build on existing network administration knowledge by providing in-depth coverage of relevant concepts and job roles any systems administrator must understand when deploying services on the Internet, or in an Intranet. This course teaches you to implement various services, including the Domain Name System (DNS), Windows Internet Naming Service (WINS), Samba, Telnet, File Transfer Protocol (FTP) and additional TCP/IP services. This course emphasizes Windows 2000 implementation of these services, although Linux-specific exercises are also provided. The class combines lecture, exercises and discussion. By the end of this course, you will be able to provide foundational name resolution, file transfer and system administration services on various Internet-ready platforms.

The coursebook will assist you during the class and serve as a valuable resource when you return to your office or home. Appendixes are included in the back to provide additional information. Following this class, you should spend time reviewing the course material to apply what you have learned.

Length

Internet System Management is a 12-hour course that can be implemented in two days in a Learning Center environment. This course will take considerably longer if taught in an academic environment. Instructors should consult the Instructor Guide and the accompanying CD for sample syllabi. Each sample shows how to teach the course in either 10-week or 16-week periods. Feel free to alter these syllabi to suit your needs.

Series

Internet System Management is the first course in the CIW Server Administrator series. CIW Server Administrator consists of the following two courses:

- *Internet System Management*
- Advanced Internet System Management

Prerequisites

Students must have completed the CIW Foundations series, or be able to demonstrate equivalent Internet and operating systems knowledge.

ProsoftTraining Courseware

This coursebook was developed for instructor-led training and will assist you during class. Along with comprehensive instructional text and objectives checklists, this coursebook provides easy-to-follow hands-on labs and a glossary of course-specific terms. It also provides Internet addresses needed to complete some labs, although due to the constantly changing nature of the Internet, some addresses may no longer be valid.

The student coursebook is organized in the following manner:

course title
table of contents
list of labs
list of figures
list of tables
lessons
lesson objectives
pre-assessment questions
narrative text
<input checked="" type="checkbox"/> graphics
<input checked="" type="checkbox"/> tables and figures
<input checked="" type="checkbox"/> warnings
<input checked="" type="checkbox"/> tech notes
labs
<input checked="" type="checkbox"/> graphics
<input checked="" type="checkbox"/> tables and figures
<input checked="" type="checkbox"/> warnings
<input checked="" type="checkbox"/> tech notes
lesson summary
lesson review
appendixes
glossary
index
supplemental CD

When you return to your home or office, you will find this coursebook to be a valuable resource for applying the skills you have learned. Each lesson concludes with questions that review the material. Lesson review questions are provided as a study resource only and in no way guarantee a passing score on CIW exams.

The course is available in either an academic or a learning center version, and each version has an instructor book and a student book. Check your book to verify that you have the correct version, and whether it is an instructor or a student book. Following is a brief description of each version.

- **Academic:** Designed for students in an academic classroom environment; typically taught over a quarter (10-week) or semester (16-week) time period. Example syllabi for both timeframes are included on the instructor CD-ROM. The instructor's book and CD-ROM contain all answers, as well as activities (pen-and-paper-based labs), optional labs (computer-based labs), quizzes, a course assessment, and handouts for the instructor to assign during class or as homework. No answers exist in the student book or on the student CD-ROM. Students must obtain answers from the instructor.
- **Learning Center:** Designed for students in a learning center classroom environment; typically taught over a one-day to five-day time period (depending on the length of the course). An example implementation table is included on the instructor CD-ROM. Similar to the academic version, the instructor's book and CD-ROM contain all answers, as well as activities (pen-and-paper-based labs), optional labs (computer-based labs), quizzes, a course assessment, and handouts for the instructor to assign during class or as homework. However, the student CD-ROM also contains answers, including those to the pre-assessment questions, labs, review questions, activities, optional labs, quizzes, and the course assessment.

Course Objectives

After completing this class, you will be able to:

- Discuss common IT services, focusing on various hardware platforms and frequently used operating systems.
- Define TCP/IP configuration parameters and configure Windows 2000 and Linux systems with static IP addresses.
- Describe the various levels of user access, and create a password policy and permissions based on standard practice and procedures.
- Manage users in Windows 2000 and Linux.
- Explain and implement the Domain Name System (DNS) in Windows 2000 and Linux.
- Identify additional name resolution options for LANs and WANs, including the Windows Internet Naming Service (WINS) and Samba.
- Implement Internet services including FTP and Telnet, and control access to these services.

Classroom Setup

Your instructor has probably set up the classroom computers based on the system requirements listed below. Most software configurations on your computer are identical to those on your instructor's computer. However, your instructor may use additional software to demonstrate network interaction or related technologies.

System Requirements

Hardware

The following table summarizes the hardware requirements for all courses in the CIW program. Each classroom should be equipped with enough personal computers to accommodate each student and the instructor with his or her own system.

Note: The CIW hardware requirements are similar to the lowest system requirements for Microsoft implementation (Level 1 requirements) except that CIW requires increased hard disk space (8 GB) and RAM (128 MB). This comparison may be helpful for the many training centers that implement CIW and are also CTEC because personnel at these centers are familiar with the Microsoft hardware specifications.

CIW hardware specifications	Greater than or equal to the following
Processor	Intel Pentium II (or equivalent) personal computer with processor speed greater than or equal to 300 MHz
L2 cache	256 KB
Hard disk	8-GB hard drive
RAM	At least 128 MB
CD-ROM	32X
Network interface card (NIC)	10BaseT or 100BaseTX (10 or 100 Mbps)
Sound card/speakers	Required for instructor's station, optional for student stations
Video adapter	At least 4 MB
Monitor	15-inch monitor
Network hubs	Two 10-port 10BaseT or 100BaseTX (10 or 100 Mbps) hubs
Router	Multi-homed system with three NICs (Windows NT 4.0/2000 server)*

* *Must meet universal CIW hardware requirements.*

Software

The recommended software configurations for computers used to complete the exercises in this book are as follows.

To be installed before class:

- Microsoft Windows 2000 Server, with NTFS as the file system
- Microsoft Internet Explorer 5.x, or Netscape Navigator 6.0
- Full installation of Red Hat Linux 7.x—(see Linux installation instructions for component detail)
- Microsoft DNS Server (included in distribution)
- Microsoft Telnet Services (included in distribution)
- Microsoft IIS 5.0 (included in distribution)
- Microsoft Windows Internet Naming Service (included in distribution, but must be selected during installation)
- BIND 8 for Red Hat Linux (included in distribution, but must be selected during installation)
- Anonymous FTP services for Red Hat Linux (included in distribution, but must be selected during installation)
- Simple TCP/IP Services, Windows 2000 and Red Hat Linux (included in distribution)
- Samba for Linux (available from www.rpmfind.net), including the samba-swat package
- Linuxconf and gnome-linuxconf for Red Hat Linux (both available at www.rpmfind.net)

Connectivity

Internet access is highly recommended, but not absolutely required for this class. The minimum requirement is a network interface card for each system, and a serial line linkup using modems or DTE-drop/DTE-system cabling.

The instructor must configure a TCP/IP network (IPv4). The Instructor Guide provides instructions on how to configure the IP settings.

LAN requirements

Although not absolutely necessary, this course is designed to use three physical networks, connected by an IP router (which can be a multi-homed computer). Network A (192.168.3.0) students will use odd-numbered IP addresses. Network B (192.168.4.0) students will use even-numbered IP addresses. The instructor will use a third network with the network address 192.168.2.0. The subnet mask is 255.255.255.0. Classroom configuration is illustrated in Figure fm-1.

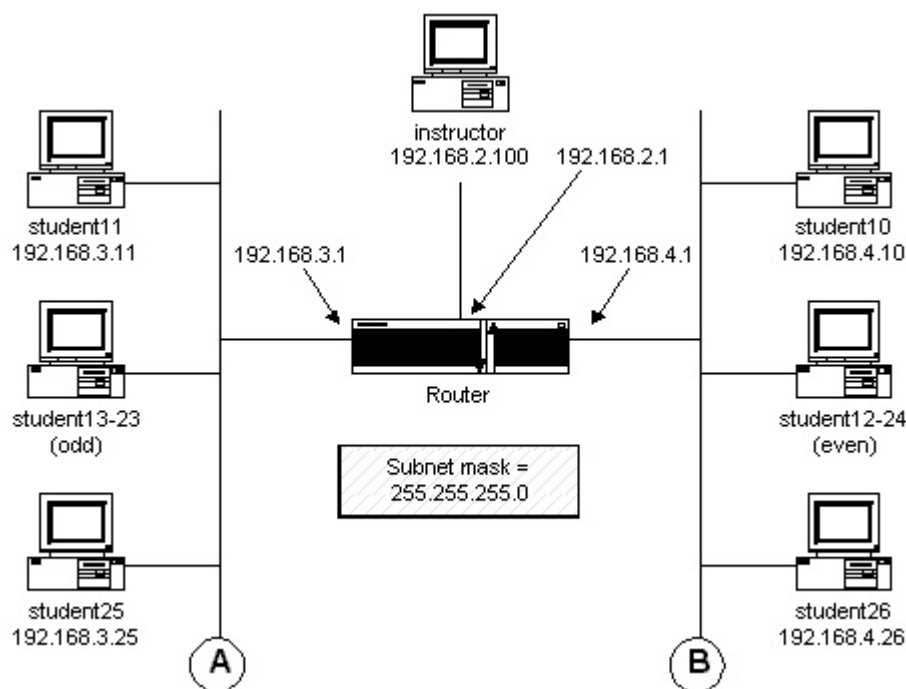


Figure fm-1: Classroom configuration

The use of statically configured IP addresses is required to conduct classroom exercises. However, to obtain a connection to the Internet, student computers can be reconfigured as DHCP clients and valid IP addresses can be obtained from a DHCP server. If necessary, program the router to masquerade connections to the Internet. The original classroom configuration can then be restored as displayed in Figure fm-1.

TCP/IP is the only network protocol used in this course. The Instructor Guide provides specific instructions on how to configure the three networks.

The instructor's computer must be able to communicate with all other computers through a router. The instructor can use a multi-homed Windows 2000 Server computer as the router. If the instructor does not have a Windows 2000 system acting as a router, he or she can use whatever router is available.

If necessary, a single-network classroom can be used.

Conventions and Graphics Used in This Book

The following conventions are used in Prosoft coursebooks.

Terms	Technology terms defined in the margins are indicated in bold the first time they appear in the text. Not every word in bold is a term requiring definition.
Exercise Text	Text that you enter in an exercise appears in bold . Names of components that you access or change in an exercise also appear in bold .
Notations	<i>Notations or comments regarding screenshots, exercises or other text is indicated in italic type.</i>
Program Code or Commands	Text used in program code or operating system commands appears in the Lucida Sans Typewriter font.

The following graphics are used in Prosoft coursebooks.



Tech Notes point out exceptions or special circumstances that you may find when working with a particular procedure. Tech Notes that occur within an exercise are displayed without the graphic.



Tech Tips offer special-interest information about the current subject.



Warnings alert you about cautions to observe or actions to avoid.



This graphic signals the start of an exercise or other hands-on activity.



Each lesson summary includes an *Application Project*. This project is designed to provoke interest and apply the skills taught in the lesson to your daily activities.



Each lesson concludes with a summary of the skills and objectives taught in that lesson. You can use the Skills Review checklist to evaluate what you have learned.

Lesson 1: IT Systems and Services Overview

Objectives

By the end of this lesson, you will be able to:

- ↗ List the services offered by IT departments.
- ↗ Identify backbone and mission-critical services offered by IT departments.
- ↗ Discuss the concepts of system maintenance, including fault tolerance, server optimization and backup.

Information Technology (IT) department

The department responsible for administering servers and supporting end users in an organization.

Introduction to Information Technology

As a systems administrator, you may work in an **Information Technology (IT)** department where each employee is responsible for one specific area, such as server installation, end user support, Web server configuration, e-mail configuration, or maintenance. However, it is more likely that you will be required to work in several areas. In a single day, you may install Windows 2000 Server to facilitate file transfer between departments, help an end user check e-mail for the first time, and configure a Linux Web server.

The purpose of this first lesson is to discuss some of the more common systems with which a server administrator will work.

Common IT Tasks and Services

As businesses adopt Internet-based services such as Web sites and e-mail, IT departments must expand their capabilities to support services and enable businesses to fulfill goals. Therefore, the IT professional's role is to provide the following types of services:

- System and service installation and configuration.
- Support for users, including troubleshooting applications and systems management.

Table 1-1 shows some of the tasks that an IT department performs. It also describes some of the services you will administer throughout your career as an IT professional. Pay special attention to the server types discussed in this table.

Table 1-1: Common IT tasks and services

Task or Service	Description
System installation	Perform operating system (OS) installation and configuration.
Web server configuration	Enable transfer of information to Internet, intranet, and extranet users via Hypertext Transfer Protocol (HTTP).
FTP server configuration and management	Enable transfer of large files across the Internet via File Transfer Protocol (FTP).
Configuring name resolution	Using the Domain Name System (DNS), the Windows Internet Naming Service (WINS) and Samba, provide local area network (LAN) and wide area network (WAN) naming.
E-mail server installation and support	Allow users to communicate across a LAN or WAN. Common e-mail servers include Microsoft Exchange, UNIX sendmail, and shareware servers such as EMWAC e-mail server.
E-commerce server installation and support	Install and maintain settings for services devoted to buying and selling on the Internet using tools such as IBM Net.Commerce and Microsoft Transaction Server E-commerce Edition.
Database server installation and support	Sample database servers include Oracle 8i, Microsoft SQL Server, and IBM DB2.
User management	Add, delete and manage users using Novell, UNIX and Windows 2000 servers. Management can also include providing (or disabling) user identification services such as finger.
Server monitoring and optimization	Use native programs that help determine optimal CPU, hard drive, and RAM usage. Such programs include UNIX ps and top programs, and the Performance snap-in in Windows 2000.
File backup	Use backup programs such as UNIX dump and cpio, as well as native Windows 2000 programs such as Disk Administrator, to safeguard against system failure.

Table 1-1: Common IT tasks and services (cont'd)

Task or Service	Description
Routing	Ensure that messages and packets travel from one user to another in a controlled and timely manner. This function is accomplished with routers, bridges and switches.
Establishing and managing shares	Establishing a share offers space on a server's hard drive to remote users. UNIX systems allow access through the use of the Network File System (NFS), whereas Windows 2000 utilizes Microsoft Networking.
LAN and WAN planning	Network design and planning requires experts in TCP/IP, routing, user management, e-mail addressing, and security.
Security management	After the network becomes operational, qualified individuals need to monitor the network for problems. Security issues can include monitoring network routers and servers for various attacks, determining user-level access problems, checking servers for improper permissions, checking logs, and checking the configuration of network servers (e-mail, DNS, Web and so forth).
Address management	Many networks use the Dynamic Host Configuration Protocol (DHCP) to ensure all computers on the network are able to communicate on the network. A special server can be configured to assign addresses to client computers.



The chief difference between a service (i.e., daemon) and an application is that a service runs more or less full-time on the "back end" (e.g., on a Windows 2000 server or a UNIX box). Applications are deployed for specific user tasks, such as checking e-mail, editing a file or configuring an IP address.

As you can see, IT departments offer a multitude of services. These services can be categorized as either backbone or mission-critical, and can be divided between local area networks (LANs) and wide area networks (WANs).

Backbone services

Backbone services provide the foundation for a working LAN or WAN, and are often used by additional services to allow communication. Because these services generally operate in the background, they are often ignored, but are nevertheless essential. Following is a limited list of essential services.

- **Naming services:** These include the Domain Name System (DNS), the Windows Internet Naming Service (WINS), and Samba, which enables UNIX systems to participate in Windows networking. Naming services also include Dynamic DNS (DDNS), which allows DNS name-to-IP address mapping changes automatically. Companies such as TZO (www.tzo.com) offer this service. With the advent of Windows 2000, dynamic DNS has become popular in LANs, as well.
- **Address management:** You can coordinate DHCP servers with naming servers to ensure that all systems have the most current addressing information.
- **Directory services:** These services centralize resources, such as servers, printers and Internet access. Examples include Novell Directory Services (NDS), the Windows NT Directory Services (NTDS) found in Windows NT 4.0, and the Windows NT Active Directory found in Windows 2000. Linux servers use the Lightweight Directory Access Protocol (LDAP) to provide directory services.
- **Central logon:** This single logon point allows access to additional resources (such as servers, printers and the Internet). A server of this type provides the ability for a user to maintain a single user name and password, yet access multiple resources or domains. Examples include Windows NT and NIS domains, as well as the **Kerberos** implementations found in Windows 2000 and various UNIX flavors (including Linux). The activity of authenticating with one server to access additional resources is often called single sign-on authentication.
- **Routing:** Whenever you connect one LAN to another, you can use a bridge, a router, or a switch. Routers are the most common. You may be asked to configure routers or handle other routing issues.
- **Public Key Infrastructure (PKI):** These services allow networks to secure communications by authenticating users and encrypting transmissions. PKI servers use special files called certificates, which provide authoritative proof concerning identity.

Kerberos

A secure method of providing a central logon. Kerberos authentication does not allow passwords to travel across the network, and provides granular access to resources on a timed basis.

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Mission-critical services

Any service provided by IT is potentially mission-critical. Generally, the more visible a system is and the more dependent users are on it, the more mission-critical the system is. Mission-critical services can include:

- World Wide Web servers (Microsoft Internet Information Server (IIS), Apache Server and so forth).
- Database, application and e-commerce servers (any service designed to collect, gather and present information across a network).
- FTP servers (Wu-FTPD and IIS, for example).

The best way to determine a mission-critical service is to identify the nature of the business. E-commerce sites focus on Web servers and accompanying support servers, including databases and other **middleware**. For example, if a business wants to provide real-time audio and video, then a streaming video server, such as RealServer (www.real.com), becomes mission-critical to that particular business. You must prioritize the various services your company offers.

middleware

Software that extends the capabilities of a Web server. Middleware can include Java servlets, application servers, and other servers that enable you to organize and direct information between an end user and a Web server.

E-mail

For many companies, the e-mail server is the ultimate mission-critical service. Mail servers can store, send and receive e-mail messages using several protocols, including Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP), and the Internet Message Access Protocol (IMAP). These three protocols reside at the application layer of the OSI reference model. Popular mail servers include Netscape Messaging Server and Microsoft Exchange Server.

- **SMTP:** responsible solely for sending e-mail messages. In UNIX, for example, the sendmail program activates in response to a command and sends the requested message.
- **POP:** the simplest protocol for storing and receiving e-mail messages. It is currently called POP3 because it is in its third iteration. POP responds to a request, asks for the appropriate password, then downloads the message from the server to the intended recipient, who can then read, delete or otherwise manage it.
- **IMAP:** handles messages in a more sophisticated manner than POP by allowing a user to browse and manage files remotely.

Sometimes, the SMTP and POP3 servers reside on separate machines.

End user support: troubleshooting

A commonly overlooked service provided by IT professionals is the role of troubleshooter. An efficient IT professional can assess a problem quickly and has the proper tools to resolve it. Although the IT professional's job is mostly technical in nature, good interpersonal skills are critical for successful interactions with users.

LAN vs. WAN services

Many of the services discussed thus far offer a variety of applications depending on the situation. For example, due to security issues, it is not wise to extend NFS or Microsoft shares over Internet connections. Therefore, offer these services from your machine only in a LAN or controlled WAN environment.

However, e-mail, Web and FTP services apply to almost any environment. You can offer them within a LAN environment to create an **intranet**, or you can offer them across the Internet or an **extranet**.

intranet

A network that provides Internet-based services to end users within a specific organization or division within an organization.

extranet

A private network shared by two organizations or company divisions over a public connection, such as the Internet. An extranet employs a Virtual Private Network (VPN) connection to encrypt transmissions.

System Configuration

As a systems administrator, you must be able to configure both end-user and back-end systems. This configuration includes binding protocols such as TCP/IP to the network interface card (NIC), and checking the status of the communication protocol being used (e.g., TCP/IP, NetBEUI or IPX/SPX). Additional issues include:

- Addressing.
- Gateways.
- Name resolution configuration.
- Service and application installation and management.
- Automated and manual IP addressing. You can configure clients so that they automatically receive addressing, name resolution and gateway information.

User Management

User management includes adding and removing users from the system and utilizing the applications specific to that operating system. For example, the Computer Management snap-in performs this function in Windows 2000. The useradd program performs the same tasks in UNIX systems. Additional user management issues include the following.

- **Permissions:** can be granted to users over resources that belong to an individual server, or which are controlled by a centralized logon server such as a Windows Primary Domain Controller (PDC) or a Kerberos server.
- **Group membership:** the most efficient way to manage user permissions.
- **Password aging:** the ability to make a password expire after a certain period of time.
- **Account lockout:** the ability to lock out an account permanently, or for a certain period of time, if a user repeatedly fails logon.
- **Password history:** the ability to require users to choose strong passwords.
- **Controlled access:** the ability to provide user-level access to directories and files.

System Performance

Another IT department function is determining exactly how a particular system is performing. Performance monitoring involves checking system components, including:

- Bandwidth and access rate issues.
- System I/O performance, including traffic on the NIC.
- Hard drive access statistics, including capacity and access rate.
- CPU usage.
- Amount of random access memory (RAM) used.

You will learn how to monitor performance in both Windows 2000 and UNIX as you implement various internetworking services.

Maintenance and Backup

System maintenance and backup issues are related to performance and include:

- Upgrading operating systems.
- Installing service packs and hot fixes.
- Upgrading services, including Web and e-mail servers.
- Scanning hard drives for errors.
- Upgrading hard drives to provide more storage capacity.

A service pack is a self-contained, all-inclusive patch designed to bring the Windows 2000 operating system up to the latest vendor-mandated specifications. Most vendors issue service packs on a regular basis (e.g., approximately every six months). A hot fix is generally a vendor solution for a specific problem. Most vendors issue hot fixes as problems are discovered and solved. Although delivery times vary, hot fixes have been issued within days or weeks of each other. Most of the time, a service pack will contain all of the relevant hot fixes issued in previous months. Backup issues include:

- Creating secondary naming, authentication and directory services servers. Many times, these servers will automatically substitute for failed servers.
- Archiving user-created files, such as Microsoft Word and Excel documents.
- Keeping copies of entire operating systems, complete with customized configurations.
- Storing changes to databases, as well as other volatile data stores. This list can include human resources databases and e-commerce databases.
- Offsite storage to ensure recovery from catastrophic events (i.e., to protect data against man-made and natural disasters).

Single-boot and dual-boot machines

Two operating systems can be placed on one machine. This application requires multiple partitions, with one operating system (such as Windows 2000) placed on the first partition, and another (such as Linux) placed on the second partition. A dual-boot system requires a **boot manager**, software that allows you to choose between the operating systems. Linux, for example, uses the Linux Loader (LILO) and GRUB boot managers. Other boot managers exist as well. LILO remains the most universal boot manager for Linux.

boot manager
An application, such as Linux Loader (LILO) or the Windows 2000 Boot Manager, that is stored on a system's hard drive. The boot manager allows users to choose between operating systems.

Lesson Summary

Application project



Visit the following sites to learn more about common providers of Internet servers and daemons:

- Oracle databases:
www.oracle.com
- Apache Server, the most popular Web server: *www.apache.org*
- Windows e-mail server:
www.mdaemon.com
- UNIX/Linux SMTP server:
www.sendmail.org
- UNIX/Linux POP3 and IMAP server:
www.washington.edu/imap
- UNIX/Linux FTP server:
www.wu-ftp.org
- UNIX/Linux DNS server:
www.bind.org
- Windows FTP and e-mail servers: *www.ipswitch.com*

Each of these sites is helpful when choosing and deploying Internet servers. Conduct searches using sites such as Google (*www.google.com*) to learn about additional vendors.



Skills review

In this lesson, you learned the basic elements of an IT professional's job. You learned about common services provided by IT departments, including service installation and user management, and how these services combine to create an overall business solution. You also reviewed system management and maintenance issues. With this foundation, you can now explore specific issues that relate to managing networking and internetworking servers.

Now that you have completed this lesson, you should be able to:

- ✓ List the services offered by IT departments.
- ✓ Identify backbone and mission-critical services offered by IT departments.
- ✓ Discuss the concepts of system maintenance, including fault tolerance, server optimization and backup.

Lesson 1 Review

1. Describe the functions of the Information Technology (IT) department.

2. What is a backbone service?

3. Describe a mission-critical service.

4. List several user management tasks for which systems administrators are responsible.

5. Describe the activity of configuring a system for TCP/IP.

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