



Course Booklet

CCNA Discovery

**Networking for Home
and Small Businesses**

Version 4.0

CCNA Discovery Course Booklet Networking for Home and Small Businesses, Version 4.0

Cisco Networking Academy

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Course Introduction

Welcome

Welcome to the CCNA Discovery course, Networking for Home and Small Businesses. The goal of this course is to introduce you to fundamental networking concepts and technologies. This course provides a hands-on introduction to networking and the Internet using tools and hardware commonly found in the home and small business environment. These online materials will assist you in developing the skills necessary to plan and implement small networks across a range of applications. This course prepares you with the skills needed to obtain entry-level Home Network Installer jobs. It also prepares you for some of the skills needed for Network Technician, Computer Technician, Cable Installer, and Help Desk Technician jobs.

More than just information

This computer-based learning environment is an important part of the overall course experience for students and instructors in the Networking Academy. These online course materials are designed to be used along with several other instructional tools and activities. These include:

- Class presentation, discussion, and practice with your instructor
- Hands-on labs that use networking equipment within the Networking Academy classroom
- Online scored assessments and grade book
- Packet Tracer 4.1 simulation tool
- Additional software for classroom activities

A global community

When you participate in the Networking Academy, you are joining a global community linked by common goals and technologies. Schools, colleges, universities and other entities in over 160 countries participate in the program. You can see an interactive network map of the global Networking Academy community at <http://www.academynetspace.com>.

The material in this course encompasses a broad range of technologies that facilitate how people work, live, play, and learn by communicating with voice, video, and other data. Networking and the Internet affect people differently in different parts of the world. Although we have worked with instructors from around the world to create these materials, it is important that you work with your instructor and fellow students to make the material in this course applicable to your local situation.

Keep in Touch

These online instructional materials, as well as the rest of the course tools, are part of the larger Networking Academy. The portal for the program is located at <http://cisco.netacad.net>. There you will obtain access to the other tools in the program such as the assessment server and student grade book), as well as informational updates and other relevant links.

Mind Wide Open®

An important goal in education is to enrich you, the student, by expanding what you know and can do. It is important to realize, however, that the instructional materials and the instructor can only facilitate the process. You must make the commitment yourself to learn new skills. Below are a few suggestions to help you learn and grow.

1. Take notes. Professionals in the networking field often keep Engineering Journals in which they write down the things they observe and learn. Taking notes is an important way to help your understanding grow over time.
2. Think about it. The course provides information both to change what you know and what you can do. As you go through the course, ask yourself what makes sense and what doesn't. Stop and ask questions when you are confused. Try to find out more about topics that interest you. If you are not sure why something is being taught, consider asking your instructor or a friend. Think about how the different parts of the course fit together.
3. Practice. Learning new skills requires practice. We believe this is so important to e-learning that we have a special name for it. We call it e-doing. It is very important that you complete the activities in the online instructional materials and that you also complete the hands-on labs and Packet Tracer® activities.
4. Practice again. Have you ever thought that you knew how to do something and then, when it was time to show it on a test or at work, you discovered that you really hadn't mastered it? Just like learning any new skill like a sport, game, or language, learning a professional skill requires patience and repeated practice before you can say you have truly learned it. The online instructional materials in this course provide opportunities for repeated practice for many skills. Take full advantage of them. You can also work with your instructor to extend Packet Tracer, and other tools, for additional practice as needed.
5. Teach it. Teaching a friend or colleague is often a good way to reinforce your own learning. To teach well, you will have to work through details that you may have overlooked on your first reading. Conversations about the course material with fellow students, colleagues, and the instructor can help solidify your understanding of networking concepts.
6. Make changes as you go. The course is designed to provide feedback through interactive activities and quizzes, the online assessment system, and through interactions with your instructor. You can use this feedback to better understand where your strengths and weaknesses are. If there is an area that you are having trouble with, focus on studying or practicing more in that area. Seek additional feedback from your instructor and other students.

Explore the world of networking

This version of the course includes a special tool called Packet Tracer 4.1®. Packet Tracer is a networking learning tool that supports a wide range of physical and logical simulations. It also provides visualization tools to help you to understand the internal workings of a network.

The Packet Tracer activities included in the course consist of network simulations, games, activities, and challenges that provide a broad range of learning experiences.

Create your own worlds

You can also use Packet Tracer to create your own experiments and networking scenarios. We hope that, over time, you consider using Packet Tracer – not only for experiencing the activities included in the course, but also to become an author, explorer, and experimenter.

The online course materials have embedded Packet Tracer activities that will launch on computers running Windows® operating systems, if Packet Tracer is installed. This integration may also work on other operating systems using Windows emulation.

Introduction

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2.1 Choosing the Operating Systems

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2.1.1 Purpose of an Operating System

System components and peripherals, by themselves, are nothing more than a collection of electronics and mechanical parts. To get these parts to work together to perform a specific task, a special type of computer program, known as an operating system (OS), is required.

Suppose that a user wants to write a report and print it out on an attached printer. A word processing application is required to accomplish this task. Information is entered from the keyboard, displayed on the monitor, saved on the disk drive and then finally sent to the printer.

In order for the word processing program to accomplish all of this, it must work with the OS, which controls input and output functions. In addition, the entered data is manipulated inside of the computer, stored in RAM and processed by the CPU. This internal manipulation and processing is also controlled by the OS. All computerized devices, such as servers, desktops, laptops or handhelds, require an OS in order to function.

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The OS acts like a translator between user applications and the hardware. A user interacts with the computer system through an application, such as a word processor, spreadsheet, computer game or *instant messaging* program. Application programs are designed for a specific purpose, such as word processing, and know nothing of the underlying electronics. For example, the application is not concerned with how information is entered into the application from the keyboard. The operating system is responsible for the communication between the application and the hardware.

When a computer is powered on, it loads the OS, normally from a disk drive, into RAM. The portion of the OS code that interacts directly with the computer hardware is known as the *kernel*. The portion that interfaces with the applications and user, is known as the *shell*. The user can interact with the shell using either the command line interface (*CLI*) or graphical user interface (*GUI*).

When using the CLI, the user interacts directly with the system in a text-based environment by entering commands on the keyboard at a command prompt. The system executes the command, often providing textual output. The GUI interface allows the user to interact with the system in an environment that uses graphical images, multimedia, and text. Actions are performed by interacting with the images on screen. GUI is more user friendly and requires less knowledge than CLI of the command structure to utilize the system. For this reason, many individuals rely on the GUI environments. Most operating systems offer both GUI and CLI.

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Operating systems have complete control of local hardware resources. They are designed to work with one user at a time. They enable the user to multitask. The operating system keeps track of which resources are used by which application.

In order to work with resources that are not directly connected to the computer system, a special piece of software must be added that allows a device to send and receive data from the network. This software, known as a *redirector*, may either be an integral part of the OS or may need to be installed separately as a *network client*. When installed, the operating system becomes a network operating system (*NOS*).

A NOS offers complex scheduling and user management software that allow a device to share resources between many users and treat networked resources as though they are directly connected.

2.1.2 Operating System Requirements

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There are many different operating systems available. The major groupings are listed here with some examples.

- Microsoft Windows: XP, Vista, 2003 Server
- UNIX-Based: IBM *AIX*, Hewlett Packard HPUX, and Sun Solaris
- BSD - Free BSD
- Linux-Based (Many varieties)
- Macintosh OS X
- Non-Unix Proprietary: IBM *OS/400*, *z/OS*

While most of these operating systems require the user to purchase and agree to a commercial license, there are several operating systems released under a different type of licensing scheme known as the *GNU* Public License (*GPL*).

Commercial licenses usually deny end-users the ability to modify the program in any way. Windows XP, Mac OS X and UNIX are all examples of commercial OS software.

In contrast, the GPL allows end-users to modify and enhance the code, if they desire, to better suit their environment. Some common operating systems, which are released under the GPL, include Linux and BSD.

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Operating systems require a certain amount of hardware resources. These resources are specified by the manufacturer and include such things as:

- Amount of RAM
- Hard disk space required
- Processor type and speed
- Video resolution

Manufacturers often specify both a minimum and recommended level of hardware resources. System performance at the minimum specified hardware configuration is usually poor and only sufficient to support the OS and no other functionality. The recommended configuration is usually the better option and is more likely to support standard additional applications and resources.

To take advantage of all of the features provided by an operating system, additional hardware resources such as sound cards, NICs, modems, microphones, and speakers are generally required. Many of the OS developers test various hardware devices and certify that they are compatible with

the operating system. Always confirm that the hardware has been certified to work with the operating system before purchasing and installing it.

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2.1.3 Operating System Selection

Choosing an appropriate OS requires many factors to be considered before deciding which one to use in a given environment.

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The first step in selecting an OS is to ensure that the OS being considered fully supports the requirements of the end user. Does the OS support the applications that will be run? Is the security and functionality sufficient for the needs of the users?

Next, conduct research to make sure that sufficient hardware resources are available to support the OS. This includes such basic items as memory, processors, and disk space, as well as peripheral devices such as scanners, sound cards, NICs and removable storage.

Another consideration is the level of human resources needed to support the OS. In a business environment, a company may limit support to one or two operating systems and discourage, or even disallow, the installation of any other OS. In the home environment, the ready availability of technical support for an OS may be a determining factor.

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When considering implementing an OS, it is the total cost of ownership (*TCO*) of the OS that must be considered in the decision making process. This not only includes the costs of obtaining and installing the OS, but also all costs associated with supporting it.

Another factor that may come into play in the decision making process is the availability of the operating system. Some countries and/or businesses have made decisions to support a specific type of OS or may have restrictions barring individuals from obtaining certain types of technologies. In this type of environment, it may not be possible to consider a particular OS regardless of its suitability to the task.

The process for selecting an operating system must take all of these factors into account.

2.2 Installing the Operating System

2.2.1 OS Installation Methods

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An OS is installed in a defined section of the hard disk, called a disk *partition*. There are various methods for installing an OS. The method selected for installation is based on the system hardware, the OS being installed, and user requirements. There are four basic options available for the installation of a new OS:

Clean Install

A clean install is done on a new system or in cases where no *upgrade* path exists between the current OS and the one being installed. It deletes all data on the partition where the OS is installed and requires application software to be reinstalled. A new computer system requires a clean install. A clean install is also performed when the existing OS installation has become damaged in some way.

Upgrade

If staying within the same OS platform, it is often possible to do an upgrade. With an upgrade, system configuration settings, applications and data are preserved. It simply replaces the old OS files with the new OS files.

Multi-boot

It is possible to install more than one OS on a computer to create a multi-boot system. Each OS is contained within its own partition and can have its own files and configuration settings. On start-up, the user is presented with a menu to select the desired OS. Only one OS can run at a time and it has full control of the hardware.

Virtualization

Virtualization is a technique that is often deployed on servers. It enables multiple copies of an OS to be run on a single set of hardware, thus creating many virtual machines. Each virtual machine can be treated as a separate computer. This enables a single physical resource to appear to function as multiple logical resources.

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2.2.2 Preparing for OS Installation

A pre-installation checklist helps ensure that the installation process is successful.

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- Step 1.** Verify that all hardware is certified to work with the selected OS.
- Step 2.** Verify that the hardware resources meet or exceed the published minimum requirements.
- Step 3.** Confirm that the appropriate installation medium is available. Due to the file size of current operating systems, they are usually available on both CD and DVD medium.
- Step 4.** If the OS is to be installed on a system that already contains data: (a) Use system diagnostic tools and utilities to ensure the current OS installation is in good condition, free of malicious or damaging files and codes; (b) Complete a full backup of all important files.
- Step 5.** If performing a clean-install, verify that all application software is available for installation.

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Before starting the installation, it is necessary to determine the partition structure that best meets user requirements.

One of the techniques available to help protect data is to divide the hard drive into multiple partitions. With a clean install, many technicians prefer to create one partition for data and a separate partition for the OS. This enables an OS to be upgraded without the risk of losing data. It also simplifies backup and recovery of data files.

It is also necessary to determine the type of *file system* to use. A file system is the method the OS uses to keep track of the files. Many different file system types exist. Commonly used file systems include *FAT 16/32*, *NTFS*, *HPFS*, *ext2*, *ext3*. Each OS is designed to work with one or more of these file system types and each file system type offers specific advantages. Careful consideration should be made to the type of file systems supported by the selected OS and the benefits of each.

Although tools exist to modify the partitioning structure and file system of a hard drive after installation, these should be avoided if possible. When modifying either the file system or partition structure on a hard drive, *data loss* may result. Careful planning can help preserve the integrity of the data.

2.2.3 Configuring a Computer for the Network

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Once an OS is installed, the computer can be configured to participate in a network. A network is a group of devices, such as computers, that are connected to each other for the purposes of sharing information and resources. Shared resources can include printers, documents and Internet access connections.

To physically connect to a network, a computer must have a network interface card (NIC). The NIC is a piece of hardware that allows a computer to connect to the network medium. It may be integrated into the computer motherboard or may be a separately installed card.

In addition to the physical connection, some configuration of the operating system is required for the computer to participate in the network. Most modern networks connect to the Internet and use the Internet to exchange information. Each computer on these networks requires an Internet Protocol (*IP*) address, as well as other information, to identify it. There are three parts to the IP configuration, which must be correct for the computer to send and receive information on the network. These three parts are:

- **IP address** - identifies the computer on the network.
- **Subnet mask** - is used to identify the network on which the computer is connected.
- **Default gateway** - identifies the device that the computer uses to access the Internet or another network.

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A computer IP address can be configured manually or assigned automatically by another device.

Manual IP Configuration

With manual configuration, the required values are entered into the computer via the keyboard, typically by a network administrator. The IP address entered is referred to as a static address and is permanently assigned to that computer.

Dynamic IP Configuration

Computers may be set up to receive network configuration dynamically. This allows a computer to request an address from a pool of addresses assigned by another device within the network. When the computer is finished with the address it is returned to the pool for assignment to another computer.

2.2.4 Computer Naming

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In addition to the IP address, some network operating systems make use of names. In this environment each individual system must have a unique name assigned to it.

A **computer name** provides a user friendly name, making it easier for users to connect to shared resources such as folders and printers on other computers.

The network administrator should determine a logical naming scheme that helps to identify a device's type and/or its location. For example, the name PRT-CL-Eng-01 could represent the first color laser printer in the Engineering Department.

These names are manually assigned to each device, although some tools do exist to help automate the naming process. A computer description can also be entered when assigning a name to provide additional information on the location or function of the device.

2.2.5 Network Name and Address Planning

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As a network grows in size and complexity, it becomes increasingly important that it is well planned, logically organized and well documented.

Many organizations develop conventions for naming and addressing of computers. These provide guidelines and rules that can be used by network support personnel when performing these tasks. Computer names must be unique and should have a consistent format that conveys meaningful information. This can help to determine device type, function, location and sequence number based on the device name. IP addresses must also be unique to each device.

The use of logical device naming and addressing conventions that are well documented can greatly simplify the task of training, network management and can help with *troubleshooting* when problems arise.

2.3 Maintaining the Operating System

2.3.1 Why and When to Apply Patches

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Once an operating system (OS) or application is installed, it is important to keep it up to date with the latest patches.

A patch is a piece of program code that can correct a problem or enhance the functionality of an application program or OS. They are usually provided by the manufacturer to repair a known vulnerability or reported problem.

Computers should be continually updated with the latest patches unless there is a good reason not to do so. Sometimes patches may negatively impact the operation of another system feature. The impact of the patch should be clearly understood before it is applied. This information can usually be found on the software manufacturer's web site.

2.3.2 Applying OS Patches

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Patches to operating systems can be installed in different ways, depending on the OS and the needs of the user. Options for downloading and installing updates include:

Automatic installation

The OS can be configured to connect to the manufacturer's web site, download and install minor updates without any user intervention. Updates can be scheduled to occur during times when the computer is on, but not in use.

Prompt for Permission

Some users wish to have control over which patches are applied. This is often the choice of users who understand what impact a patch may have on system performance. The system can be configured to notify the end-user when a patch is available. The user must then decide if the patch should be downloaded and installed.

Manual

Updates that require major pieces of code to be replaced on a system should be run manually. These major updates are often called service packs and are designed to correct problems with an application or OS, and sometimes to add functionality. These service packs usually require the end user to manually connect to a web site, download and install the update. They may also be installed from a CD that can be obtained from the manufacturer.

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2.3.3 Applications Patches and Updates

Applications also require patches and updates. Patches are usually released by the manufacturer, to repair a detected vulnerability in the application that could lead to undesirable behavior.

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Browsers and office software such as word processors, spreadsheet and database applications are common targets for network attacks. These applications require updates to correct the code that may allow the attack to succeed. The manufacturer may also develop updates that can improve product functionality, at no additional cost.

OS and applications patches are generally found through the manufacturer's website. The installation process may request permission to install the update and to verify that any supporting software is present. The installation process may also install any programs that are required to support the update. Web updates can be downloaded to the system from the Internet and installed automatically.

Refer to
Lab Activity
for this chapter

Lab Activity

Examine the current version of OS and installed application and determine whether additional patches or updates are available.

Summary

Go to
the online course
to take the quiz.

Quiz

Take the chapter quiz to check your knowledge.

Your Chapter Notes