Module 2 includes the following chapters:

- Chapter 6—Catalyst 1900 Switch Operations
- Chapter 7—Extending Switched Networks with Virtual LANs

Module 3, Interconnecting Cisco Routers

The purpose of the module is to introduce you to the router and network layer concepts. In this section, you will learn about the TCP/IP protocol stack, the IP and IPX routed protocols, and routing protocols such as RIP and IGRP. You will also learn how to control network access using access lists.

Module 3 includes the following chapters:

- Chapter 8—Interconnecting Networks with TCP/IP
- Chapter 9—Determining IP Routes
- Chapter 10—Basic IP Traffic Management with Access Lists
- Chapter 11—Configuring Novell IPX

Module 4, Extending the Network to WANs

The purpose of this module is to teach you how to configure and verify a router's WAN connectivity using a serial point-to-point connection, a Frame Relay connection, and an ISDN BRI connection.

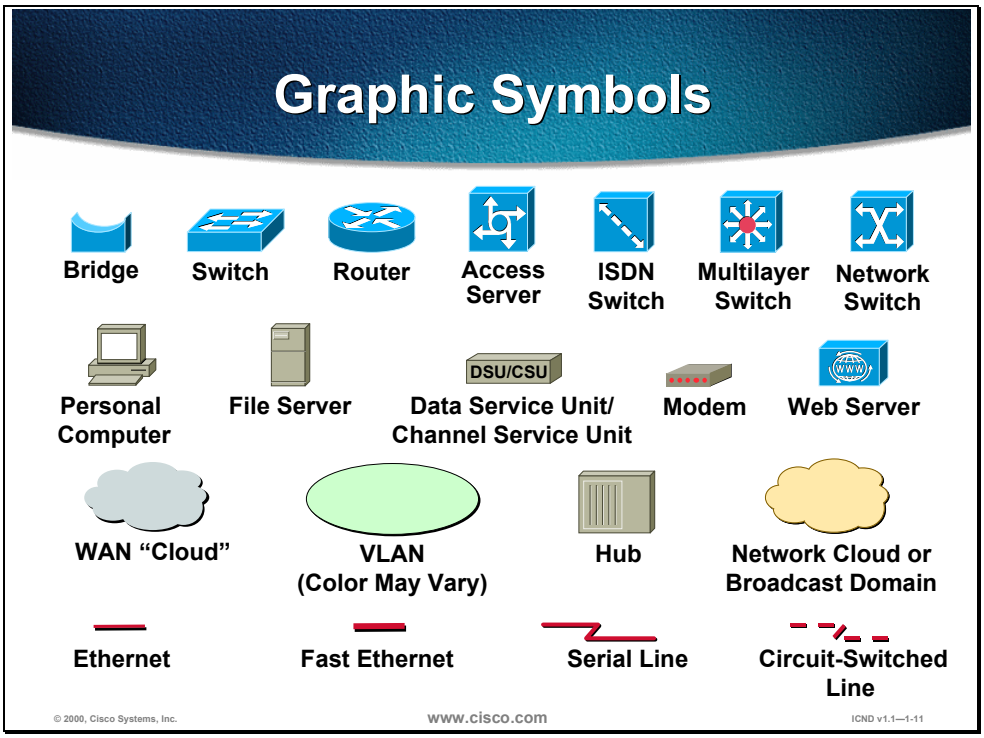
Module 4 includes the following chapters:

- Chapter 12—Establishing Serial Point-to-Point Connections
- Chapter 13—Completing an ISDN BRI Call
- Chapter 14—Establishing a Frame Relay PVC Connection

Copyright © 2000, Cisco Systems, Inc.

Graphic Symbols

This section illustrates symbols that are used throughout the course.



These symbols are used in the graphic presentations of this course to represent device or connection types.

Note The addressing schemes and telephone numbers used in this course are reserved and not to be used in the public network. They are used in this course as examples to facilitate learning. When building your network, use only the addresses and telephone numbers assigned by your network designer and service provider.

Copyright © 2000, Cisco Systems, Inc.

2

Internetworking Concepts Overview

Overview

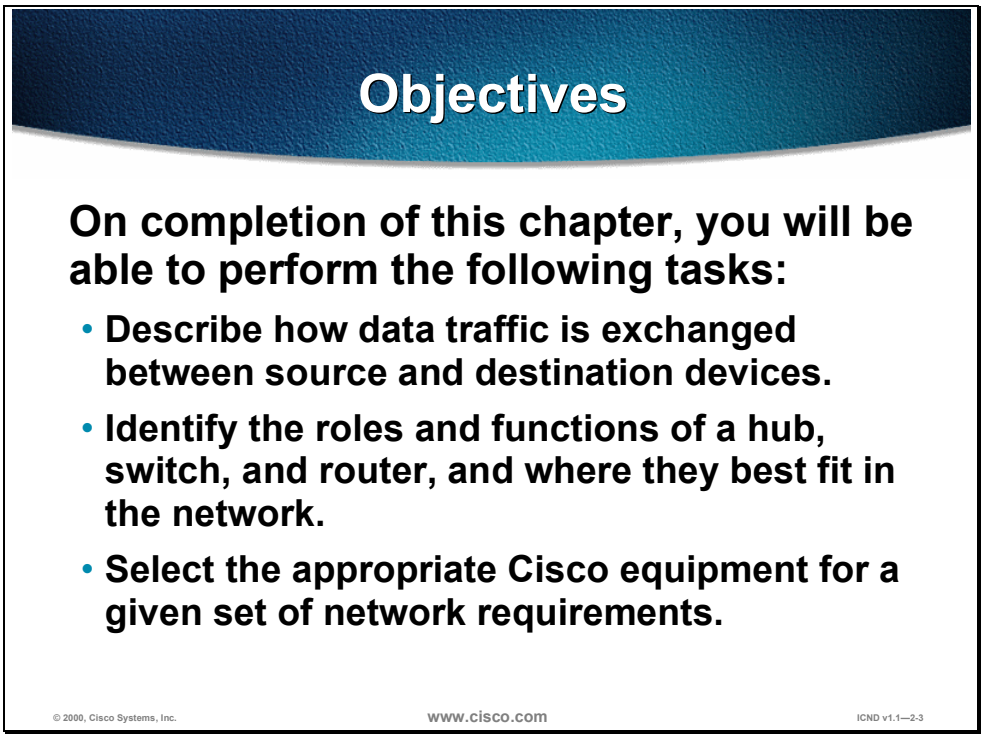
This chapter presents a review of internetworking terminology, including the Open System Interconnection (OSI) reference model and how the layers in the OSI model operate. In addition, this chapter summarizes the types of devices that are used to support specific internetwork requirements, and how to select the correct Cisco product for your internetworking needs.

It includes the following topics:

- Objectives
- Defining Network Components
- Mapping Business Needs to a Hierarchical Model
- OSI Model Overview
- Communicating Between Layers
- Written Exercise 1
- Physical Layer Functions
- Data-Link Layer Functions
- Network Layer Functions
- Transport Layer Functions
- Written Exercise 2
- Selecting Cisco Products
- Laboratory Exercise
- Summary
- Review Questions

Objectives

This section lists the chapter objectives.



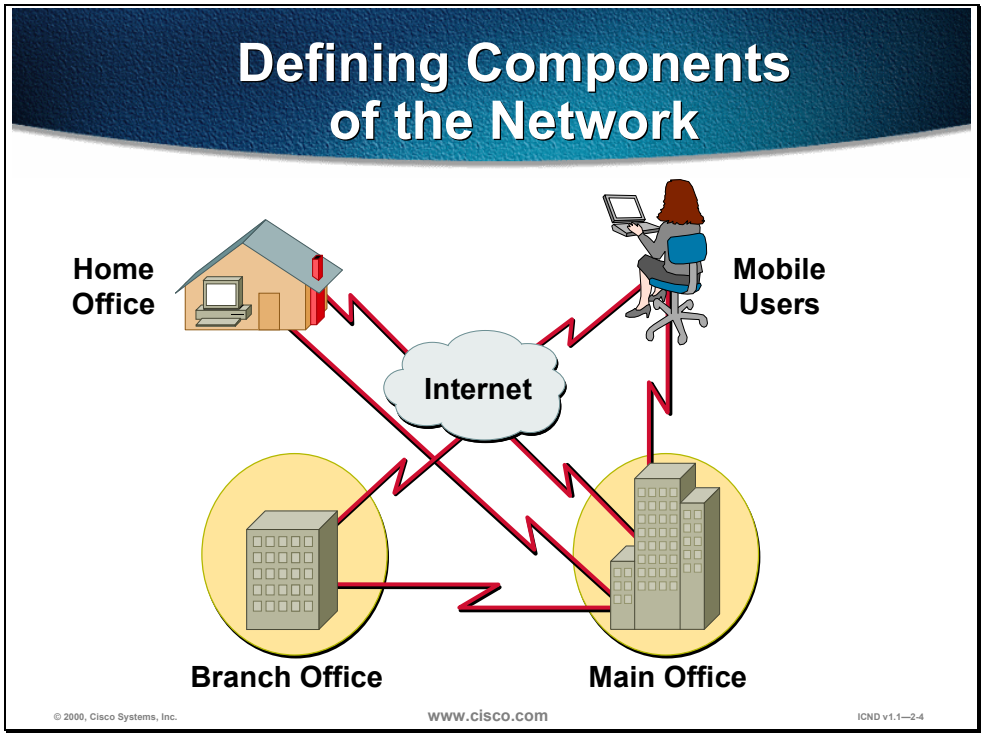
Upon completion of this chapter, you will be able to perform the following tasks:

- Describe how data moves through the network, given a data stream and network.
- Identify the roles and functions of each device and specify where each device best fits in the network, given a network topology.
- Select the appropriate Cisco equipment, given a network design that combines switching, routing, and remote access requirements.

 Copyright © 2000, Cisco Systems, Inc.

Defining Network Components

This section describes network topologies and placement of devices within the network.



One of the primary purposes of an internetwork is to increase productivity by linking computers and computer networks so that people have easy access to information regardless of differences in time, place, or type of computer system.

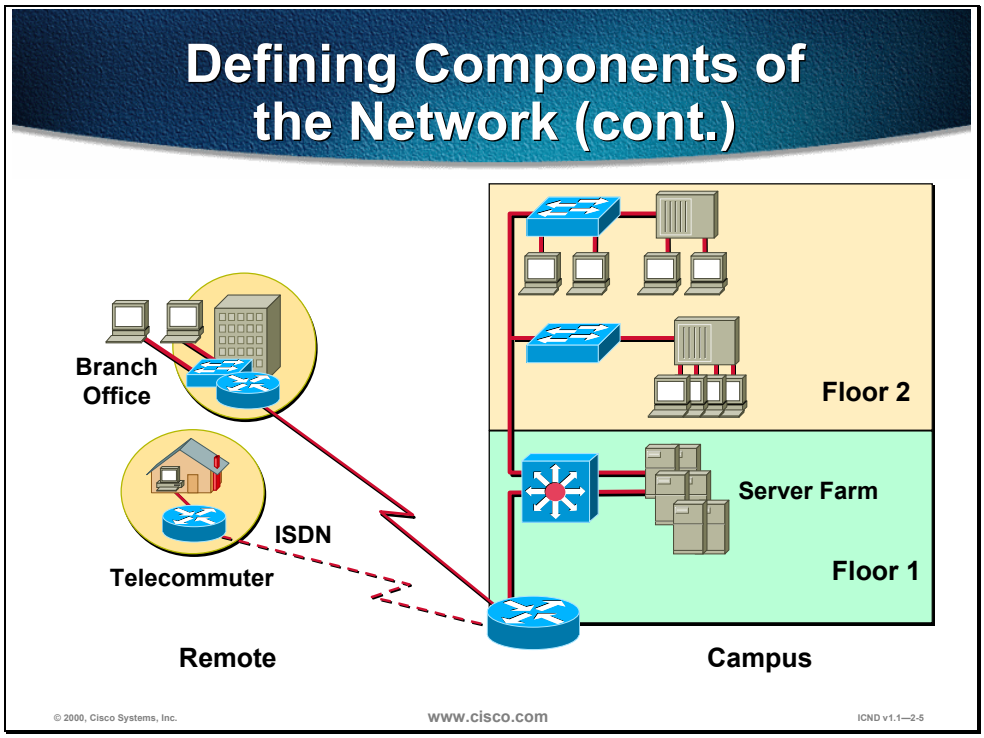
Because companies have adopted their internetwork as part of their business strategy, it is typical to subdivide and map corporate internetworks to the corporate business structure. In the figure, for example, the internetwork is defined based on the grouping of employees (users) in the following ways:

- A main office where everyone is connected via a LAN and where the bulk of corporate information is located. A main office can have hundreds or even thousands of people who depend on network access to do their jobs. It may have several LANs or be a campus that contains several buildings. Because everyone needs access to central resources and information, it is common to see a high-speed backbone LAN as well as a legacy data center with mainframe computers and applications.
- A variety of remote access locations that connect to the main office and/or each other using WAN services:
  - Branch offices—Where smaller groups of people work and connect to each other via a LAN. To connect to the main office, these users have to use WAN services. Although some corporate information may be stored at a branch office, it is more likely that they will have user resources, such as printers, but will have to access information directly from the

main office. The frequency of accessing the main office determines whether the WAN will be based on permanent or dial-up connections.

- Home offices—Where individuals work out of their homes. They will most likely require on-demand connections to the main office and/or the branch office to access information or use network resources such as file servers.
- Mobile users—These individuals connect to the main office LAN when they are at the main office, at the branch office, or on the road. Their network access needs are based on where they are located at a given point in time.

 Copyright © 2000, Cisco Systems, Inc.

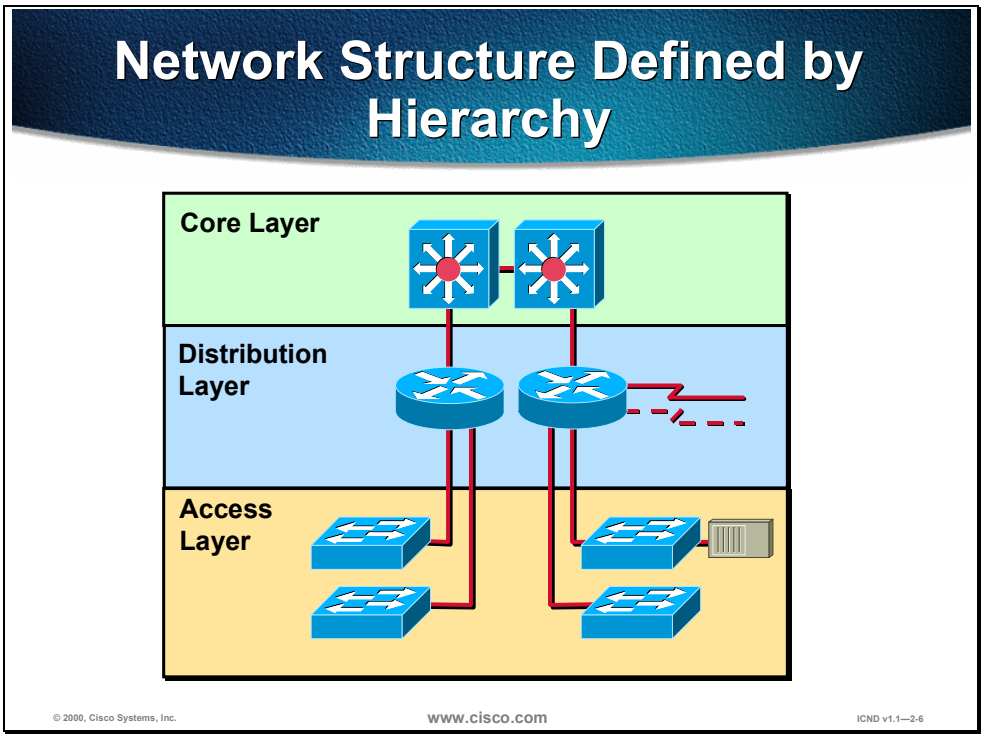


In order to understand what types of equipment and services to deploy and when in your network, it is important to understand the business and user needs. The figure shows how you can map an organization's business or user requirements to a network. You can then subdivide the network into a hierarchical model that spans from the end user's machine (the desktop) to the core (backbone) of the network.

To subdivide an internetwork into smaller components while considering how businesses use the internetwork, Cisco uses a three-layer hierarchical model.

Mapping Business Needs to a Hierarchical Model

This section describes a hierarchical model used in network design.



To simplify network design, implementation, and management, Cisco uses a hierarchical model to describe a network. Although using a model is typically associated with designers, it is important as an implementer that you understand the model. Understanding the model allows you to know what type of equipment and features are required for each device in your network.

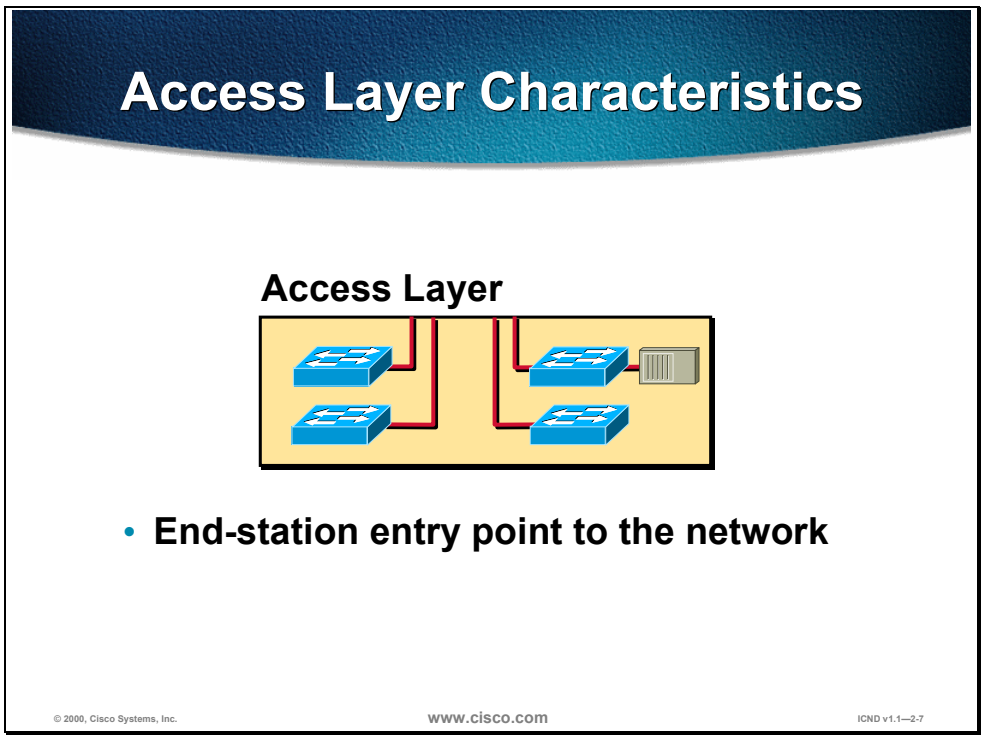
Campus networks traditionally placed basic network-level intelligence and services at the center of the network and shared bandwidth at the user level. As businesses continue to place more emphasis on the network as a productivity tool, distributed network services and switching will continue to migrate to the user level.

User demands and complex applications have forced network designers and implementers to use the traffic patterns in the network as the criteria for building an internetwork. Networks cannot be divided into subnetworks based only on the number of users. The emergence of servers that run global applications also has a direct effect on the load across the network. A higher traffic load across the entire network results in the need for more efficient routing and switching techniques.

In the new campus model, traffic patterns dictate the grouping and resulting placement of the services required by the end user. To properly build an internetwork that can view and address traffic pattern (user) requirements, the three-layer hierarchical model is organized as follows:

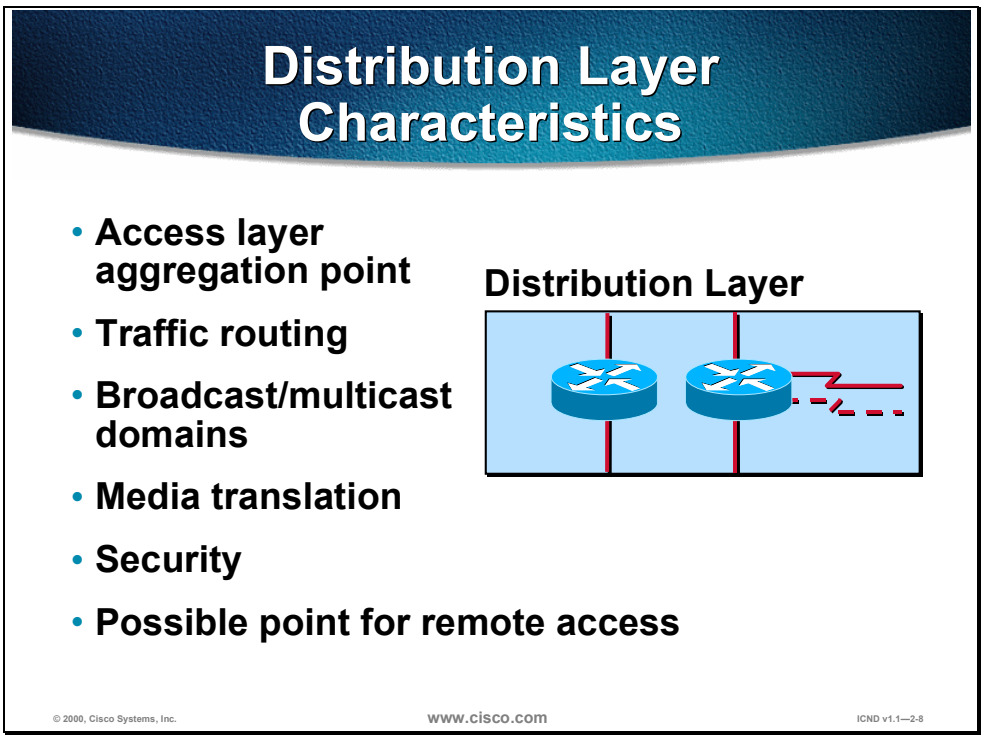
- Access layer
- Distribution layer
- Core layer

 Copyright © 2000, Cisco Systems, Inc.



The access layer of the network is the point at which end users are connected to the network. This is why it is sometimes referred to as the desktop layer. Users and the resources they need to access most are locally available. Traffic to and from local resources is confined between the resources, switches, and end users. Multiple “groups” of users and their resources exist at the access layer.

In many networks, it is not possible to provide users with local access to all services, such as printers, centralized file storage devices, or dial-out access to the Web. In these cases, user traffic for these services is directed to a layer in the network called the distribution layer.

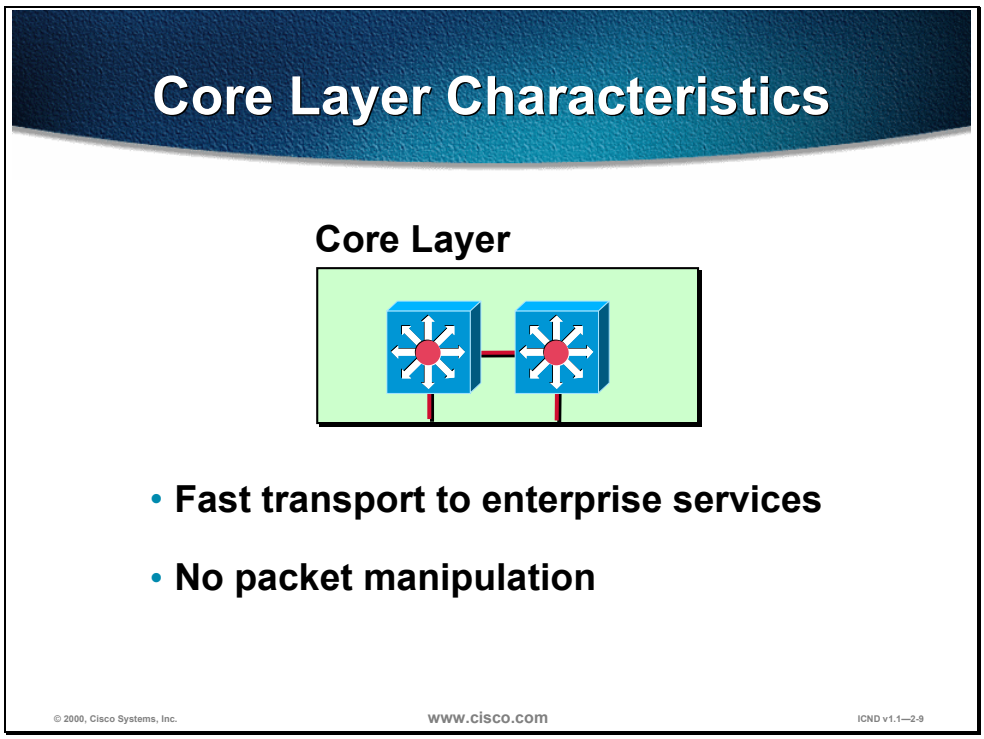


The distribution layer of the network, also referred to as the workgroup layer, marks the point between the access layer and the main "motorway" of the internetwork, called the core. The primary function of this layer is to perform potentially "expensive" packet manipulations such as routing, filtering, and WAN access. In the campus environment, the distribution layer can represent a multitude of functions, some of which are:

- Address or area aggregation for access layer groups, and for remote access entities such as branch offices or telecommuters
- Routing traffic, to provide departmental or workgroup access
- Broadcast/multicast domain definition
- Physical media translations
- Security

The distribution layer can be summarized as the layer that provides "policy-based connectivity" because it determines if and how packets can access the core or backbone. The distribution layer determines the fastest way for a user request, such as file server access, to be forwarded to the server. Once the distribution layer decides the path, it forwards the request to the core layer. The core layer then quickly transports the request, using the instructions from the distribution layer.

 Copyright © 2000, Cisco Systems, Inc.



The sole purpose of the core layer of the network is to switch traffic as fast as possible. Typically, traffic is transported to and from services that are common to a majority of users. These services are referred to as enterprise services. Examples of enterprise services would be e-mail, Internet access, or videoconferencing.

When a user must have access to enterprise services, the user's request is processed at the distribution layer. The distribution layer devices then forward the user requests to the core, or backbone. The backbone simply provides quick transport to the desired enterprise service. Determining if and how a packet can get transported through the core is the role of the distribution layer.

Once you understand how an internetwork is used from a business and user-needs standpoint and can map those needs to a model, you are ready to understand how to build the internetwork.

One way to understand how to build an internetwork is to first understand its conceptual framework. The most popular conceptual framework of how internetworks are built and operate is the OSI model.