



CCNA Discovery II Working at a Small-to- Medium Business or ISP



Planning a Network Upgrade— Chapter 3

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Objectives

After completion of this chapter, you should be able to:

- Perform a customer site survey.
- Describe the importance of planning when beginning a network upgrade.
- Describe physical topology considerations when upgrading a network.
- Describe structured cabling.
- Describe network configuration and interaction of network devices.
- Describe other considerations when planning an upgrade.

Site Survey

- When a small company grows rapidly, the original network that supports the company often cannot keep pace with the expansion. Employees at the company may not realize how important it is to plan for network upgrades. The business may just add various network hardware devices, of varying quality, from different manufacturers, and different network connection technologies, in order to connect new users.

Site Survey

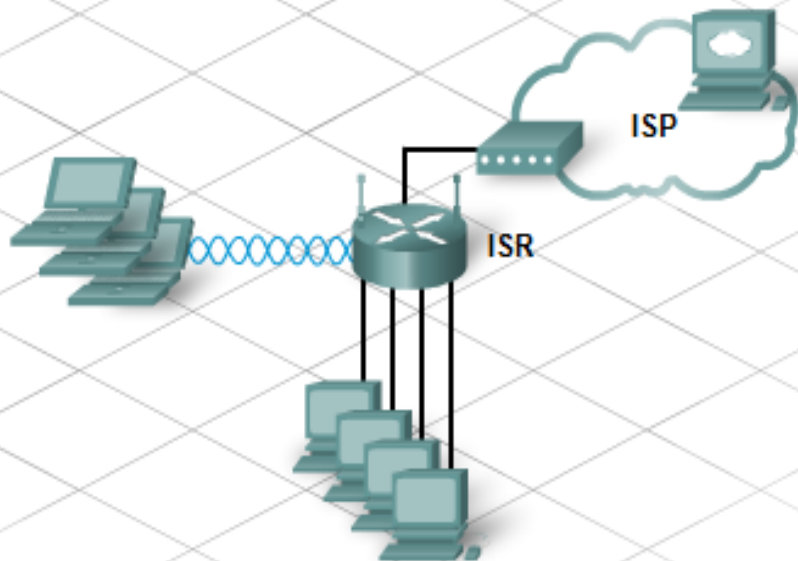
- It is at the point when the network starts to fail that most small businesses look for help to redesign the network to meet the new demands. An ISP or managed service provider may be called in to provide advice, and to install and maintain the network upgrade.

Site Survey

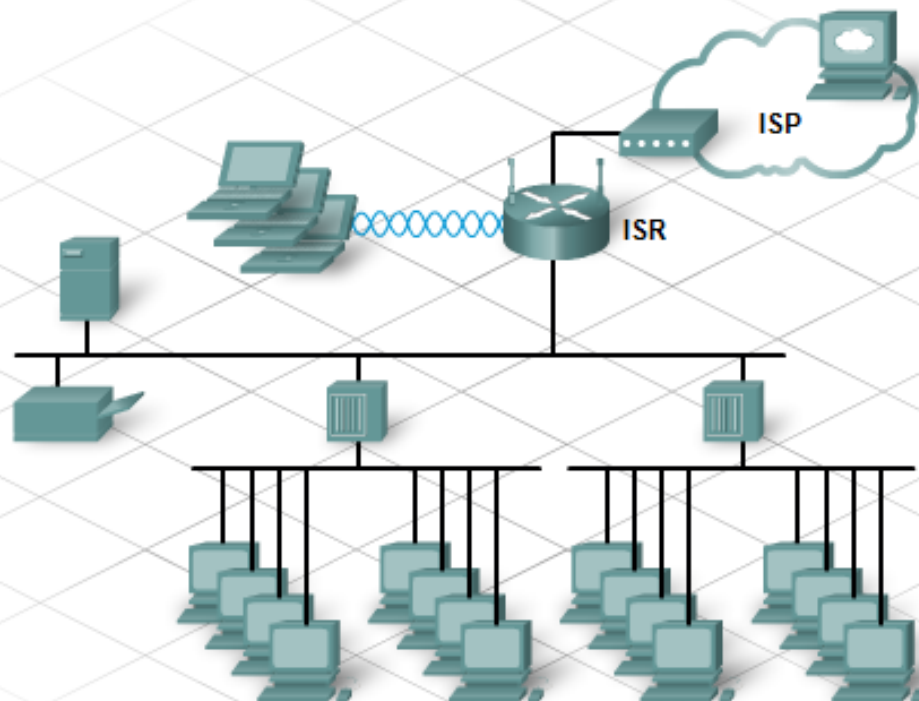
- Before a network upgrade can be properly designed, an on-site technician is dispatched to perform a site survey to document the existing network structure. It is also necessary to investigate and document the physical layout of the premises to determine where new equipment can be installed.

Site Survey

Original Network



Current Network



Site Survey

- A site survey provides much information to the network designer and creates a proper starting point for the project. It shows what is already on site, and gives a good indication as to what is needed. A sales representative may accompany the technician to the site to interview the customer as well.
- Some of the more important pieces of information that can be gathered during a site survey include:

Site Survey

- Number of users and types of equipment
- Projected growth
- Current Internet connectivity
- Application requirements
- Existing network infrastructure and physical layout
- New services required
- Security and privacy considerations
- Reliability and Uptime expectations
- Budget constraints

Site Survey



Number of Hosts and Users



Internet Service and Equipment



Existing Network Devices



Security Requirements



Application Requirements



Wireless Requirements

Site Survey

- The technician should be prepared for anything when doing the site survey. Networks do not always meet local codes of practice in terms of electrical, building or safety regulations, nor adhere to any standards.

Site Survey

- Sometimes networks grow haphazardly (irregularly) over time and end up being a mixture of technologies and protocols. The technician should be careful not to offend the customer by expressing an opinion about the quality of the existing installed network.

Site Survey

- When the technician visits the customer premises, he or she should do a thorough overview of the network and computer setup up. There may be some obvious issues such as unlabeled cables, poor physical security for network devices, lack of emergency power, or lack of a UPS for critical devices. These conditions should be noted on the technician's report, as well as the other requirements gathered from the survey and the customer interview.

Site Survey

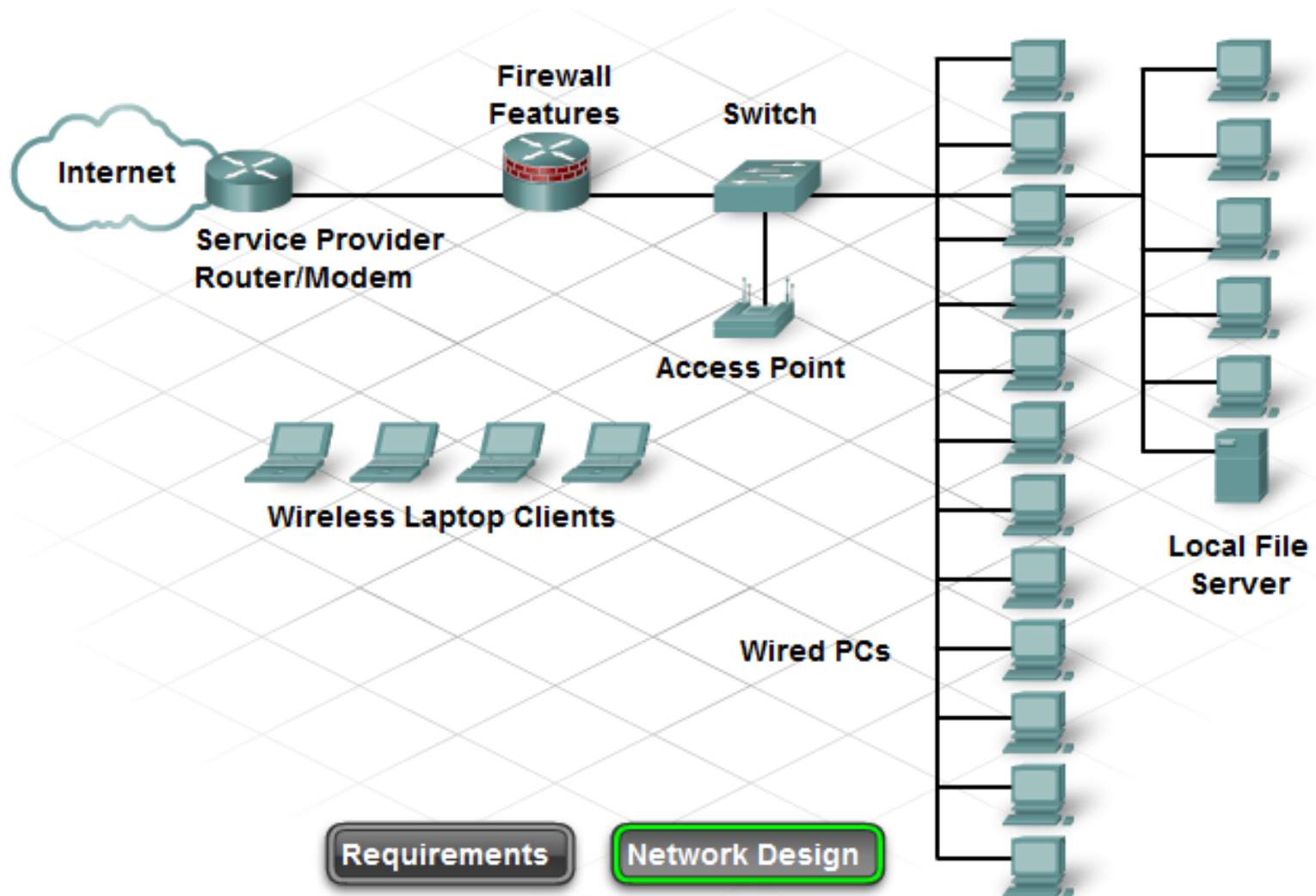
Your Custom Network Requirements

Requirement	Answer
Number of Users	We have 19 users
Service Provider Equipment	We use DSL and our service provider owns the equipment
Firewall	We have an integrated firewall
Local servers	We plan to have a file server on-site
Web or Email servers	We do not have web or email servers
Application Requirements	We run word processing, spreadsheets and graphics applications. We plan to use IP phones in the future
Wired / Wireless	We require both wired and wireless connectivity
Number of Wired Desktops	We have 15 desktop computers
Number of Printers	We have no network printers
Wireless Laptops	We have 4 wireless laptops
WLAN Area	Our offices occupy 15,000 square feet

Requirements

Network Design

Site Survey



Physical and Logical Topologies

- Both the physical and logical topologies of the existing network need to be documented. A technician gathers the information during the site survey to create both a physical and logical topology map of the network. A physical topology is the actual physical location of cables, computers, and other peripherals. A logical topology documents the path that data takes through a network and the location where network functions, like routing, occur.

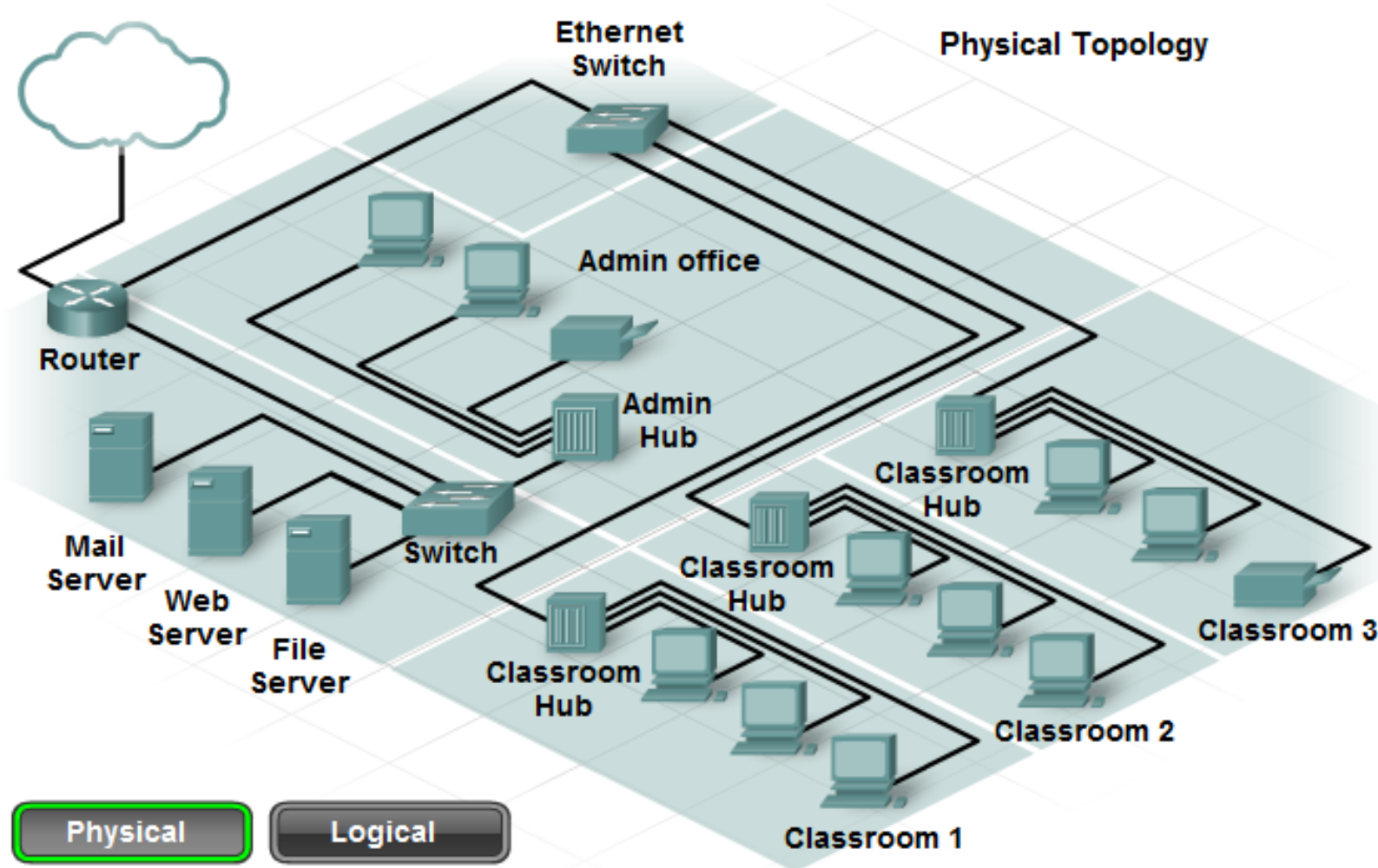
Physical and Logical Topologies

- In a wired network, the physical topology map consists of the wiring closet, as well as the wiring to the individual end user stations. In a wireless network, the physical topology consists of the wiring closet and an access point. Since there are no wires, the physical topology contains the wireless signal coverage area.

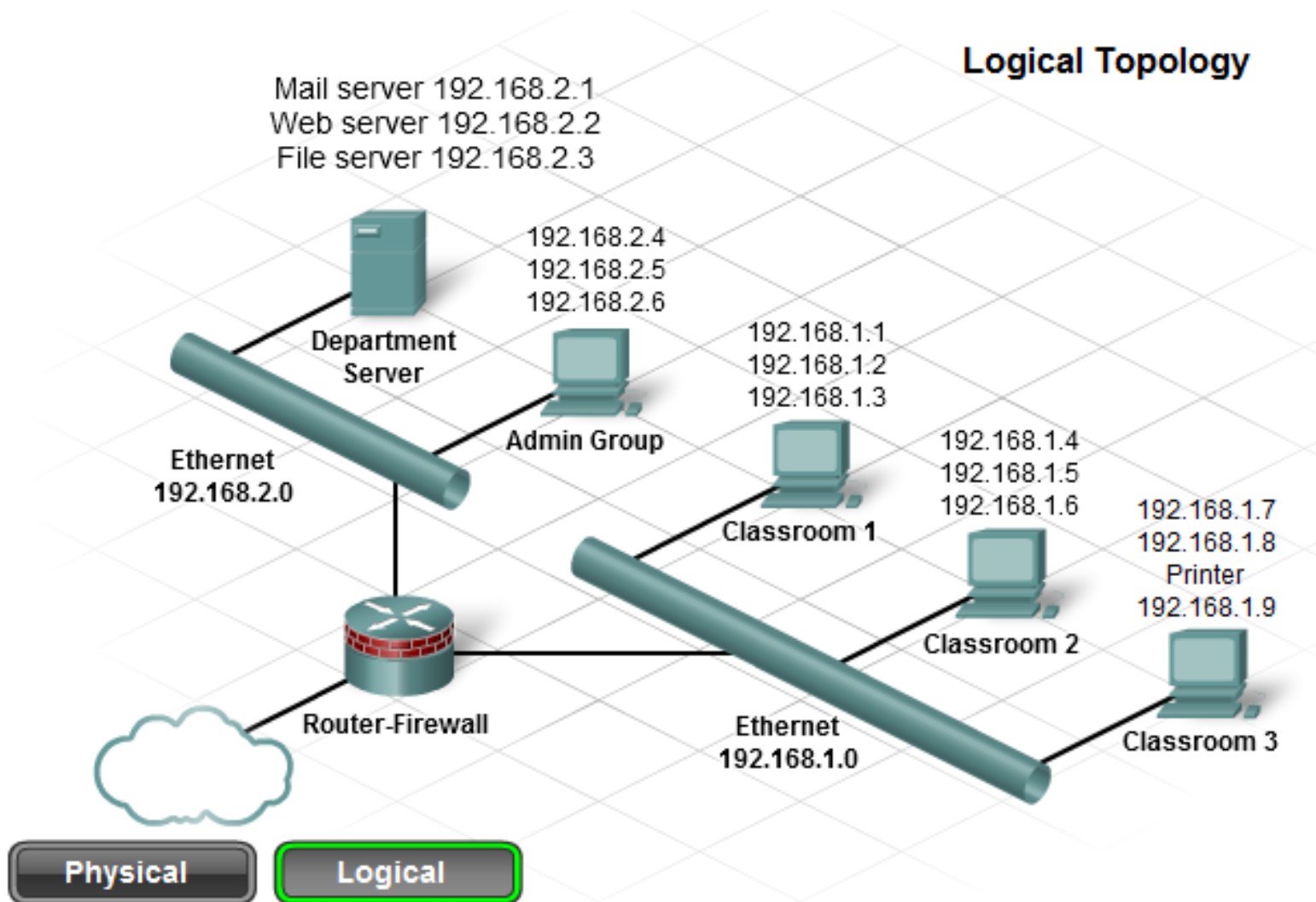
Physical and Logical Topologies

- The logical topology is generally the same for both a wired and wireless network. It includes the naming and Layer 3 addressing of end stations, router gateways, and other network devices, regardless of the physical location. It indicates the location of routing, network address translation, and firewall filtering.

Physical and Logical Topologies



Physical and Logical Topologies



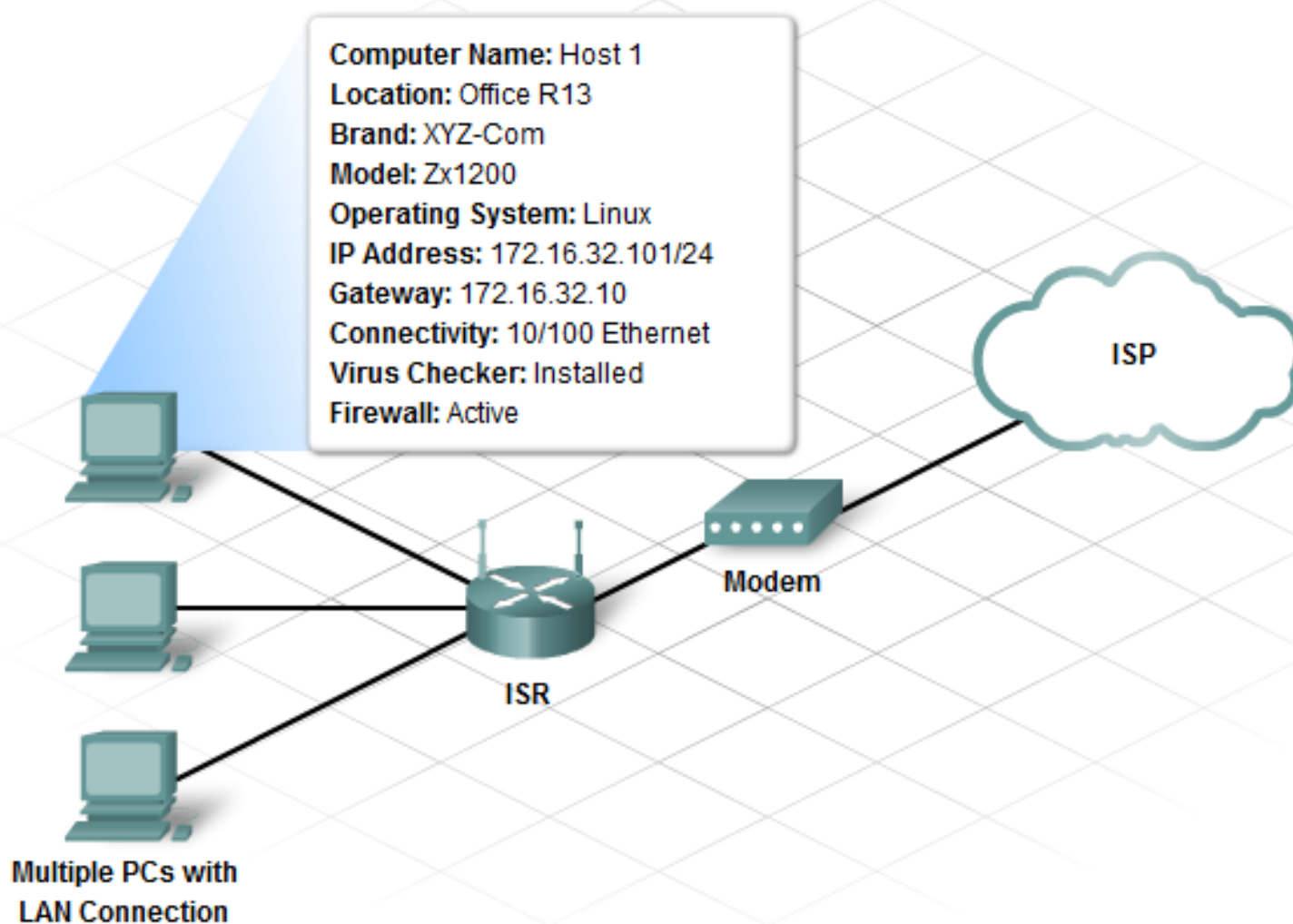
Network Requirements Documentation

- Along with creating the topology maps for the existing network, it is necessary to obtain additional information about the hosts and networking devices that are currently installed in the network. This information should be recorded on a brief inventory sheet. In addition to currently installed equipment, document any planned growth that the company anticipates in the near future.

Network Requirements Documentation

- The inventory sheet of all the network installed devices includes:
 - Device name
 - Location
 - Brand and model
 - Operating system
 - Logical addressing information
 - Method of connectivity
 - Security information

Network Requirements Documentation



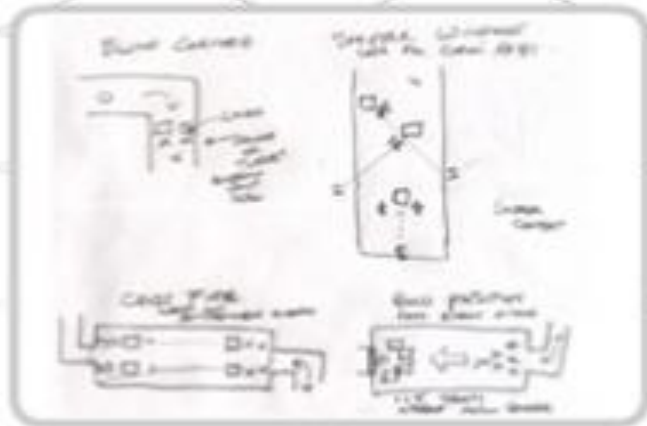
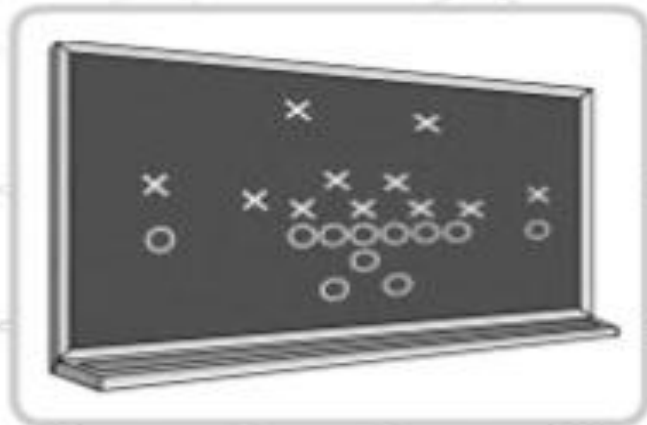
Network Upgrades

- Extensive planning should go into a network upgrade. Just like any project, a need is identified and then a plan outlines the process from beginning to end. A good project plan will help identify any strengths, weaknesses, opportunities, or threats (SWOT). The plan should clearly define the tasks, and the order in which tasks are completed.

Network Upgrades

- Examples of good planning:
- Sports teams follow game plans
- Builders follow blueprints
- Ceremonies or meetings follow agendas
- A network that is a patchwork of devices strung together, using a mixture of technologies and protocols, is usually an indicator of poor initial planning. These types of networks are susceptible to downtime, and are difficult to maintain and troubleshoot.

Network Upgrades



Network Upgrades

- The planning of a network upgrade begins after the site survey and report are completed. There are five distinct phases:
- Phase 1: Requirements Gathering
- After all information has been gathered from the customer and the site visit, it is analyzed to determine network requirements. This analysis is done by the design team at the ISP, which creates an Analysis Report.

Network Upgrades

- Phase 2: Selection and Design
- Select devices and cabling based on the requirements outlined in the Analysis Report. Create multiple designs and regularly share them with other members on the project. This allows team members to view the LAN from a documentation perspective and evaluate trade-offs in performance and cost. It is during this step that any weaknesses of the design can be identified and addressed.

Network Upgrades

- Phase 3: Implementation
- If the first two steps are done correctly, the implementation phase may be performed without incident. If there are tasks that have been overlooked in the earlier phases, they must be corrected during implementation. Creation of a good implementation schedule and allowing for some additional time for unexpected events, keeps disruption of the customer's business to a minimum.

Network Upgrades



Network Upgrades

- Phase 4: Operation
- The network is brought into service in what is termed a production environment. Prior to this step, the network is considered to be in a testing or implementation phase.

Network Upgrades

- Phase 5: Review and Evaluation
- After the network is operational, the design and implementation must be reviewed and evaluated. For this process, the following steps are recommended:
- Compare the user experience with the goals in the documentation and evaluate if the design is right for the job.

Network Upgrades

- Compare the projected designs and costs with the actual deployment. This ensures that future projects will benefit from the lessons learned on this project.
- Monitor the operation and record changes. This ensures that the system is always fully documented and accountable.

Network Upgrades

Activity

Determine if an action is part of the Requirements Gathering, Selection and Design, Implementation, Operation, or Review and Evaluation phase.

Based on the statement, select the appropriate phase.

1) The network is actively working in a production environment.

2) Prototypes of the selected devices and cables are created.

3) Actual user experiences on the upgraded network are compared with the goals in the documentation.

4) A schedule is created and followed, allowing for additional time for unexpected events. Constant communication with the customer is required.

5) An Analysis Report is created.

Phase 1 Requirements Gathering	Phase 2 Selection and Design	Phase 3 Implementation	Phase 4 Operation	Phase 5 Review and Evaluation

Network Upgrades

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	Phase 1 Requirements Gathering	Phase 2 Selection and Design	Phase 3 Implementation	Phase 4 Operation	Phase 5 Review and Evaluation
1) The network is actively working in a production environment.				✓	
2) Prototypes of the selected devices and cables are created.		✓			
3) Actual user experiences on the upgraded network are compared with the goals in the documentation.					✓
4) A schedule is created and followed, allowing for additional time for unexpected events. Constant communication with the customer is required.			✓		
5) An Analysis Report is created.	✓				

Physical Environment

- One of the first things that the network designer does to select the equipment and design of the new network is to examine existing network facilities and cabling. The facilities include the physical environment, the telecommunication room, as well as existing network wiring. A telecommunications room or wiring closet, in a small, single-floor network is usually referred to as the Main Distribution Facility (MDF).

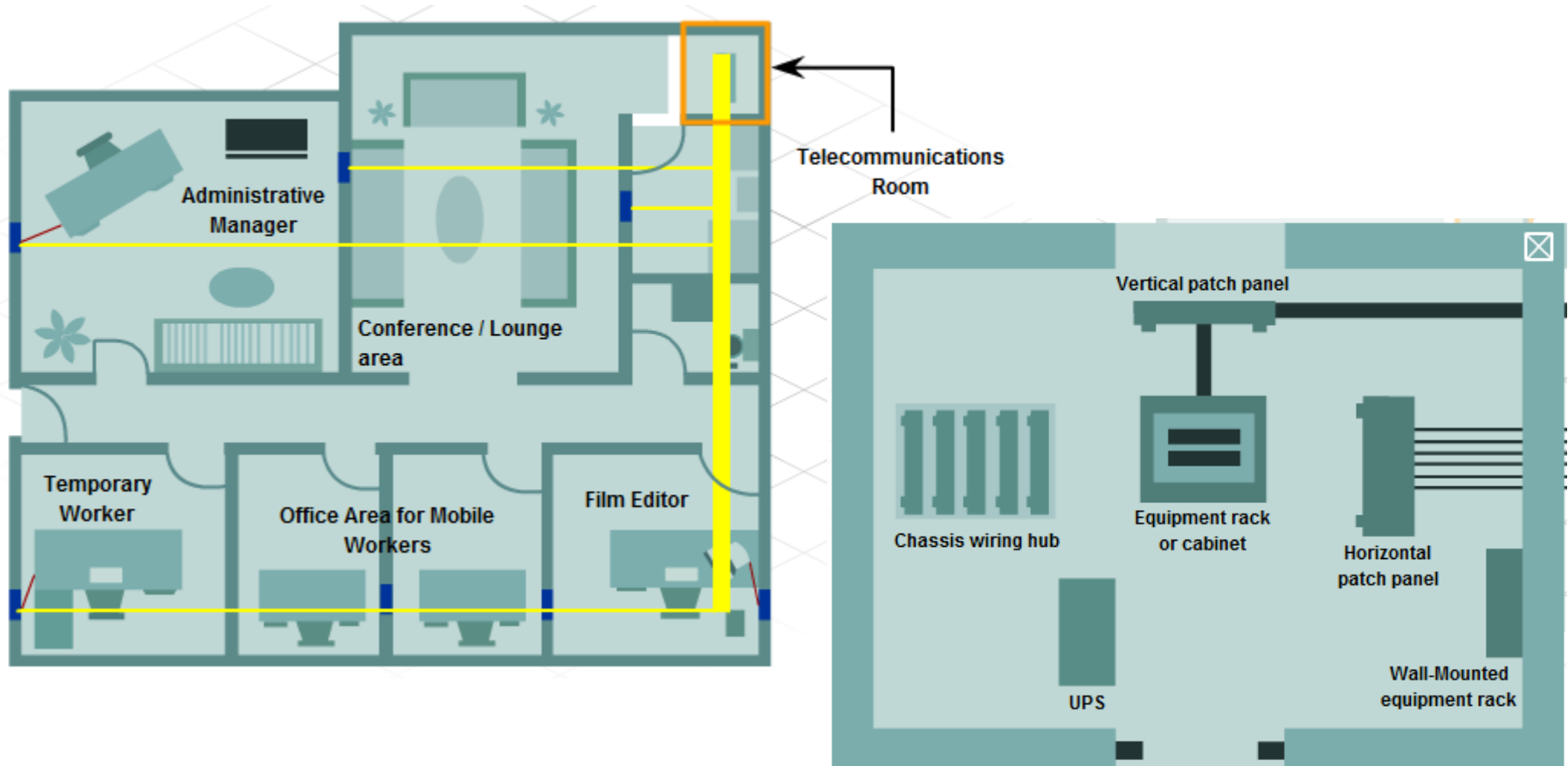
Physical Environment

- The MDF typically contains many of the network devices such as switches or hubs, routers, access points, and so on. It is where all of the network cable concentrates to a single point. Many times, the MDF also contains the Point of Presence (POP) of the ISP, where the network makes the connection to the Internet through a telecommunications service provider.

Physical Environment

- If additional wiring closets are required, these are referred to as Intermediate Distribution Facilities (IDFs). IDFs are typically smaller than the MDF and will connect to the MDF.
- In many small businesses, no telecommunications room or closet exists. Network equipment may be located on a desk or other furniture, and wires could be just lying on the floor. Network equipment must always be secure.

Physical Environment



Cabling Considerations

- When the existing cabling is not up to specification for the new equipment, new cable must be planned for and installed. The condition of the existing cabling can quickly be determined by the physical inspection of the network during the site visit. When planning the installation of network cabling, there are four physical areas to consider:
- User work areas
- Telecommunications room
- Backbone area
- Distribution area

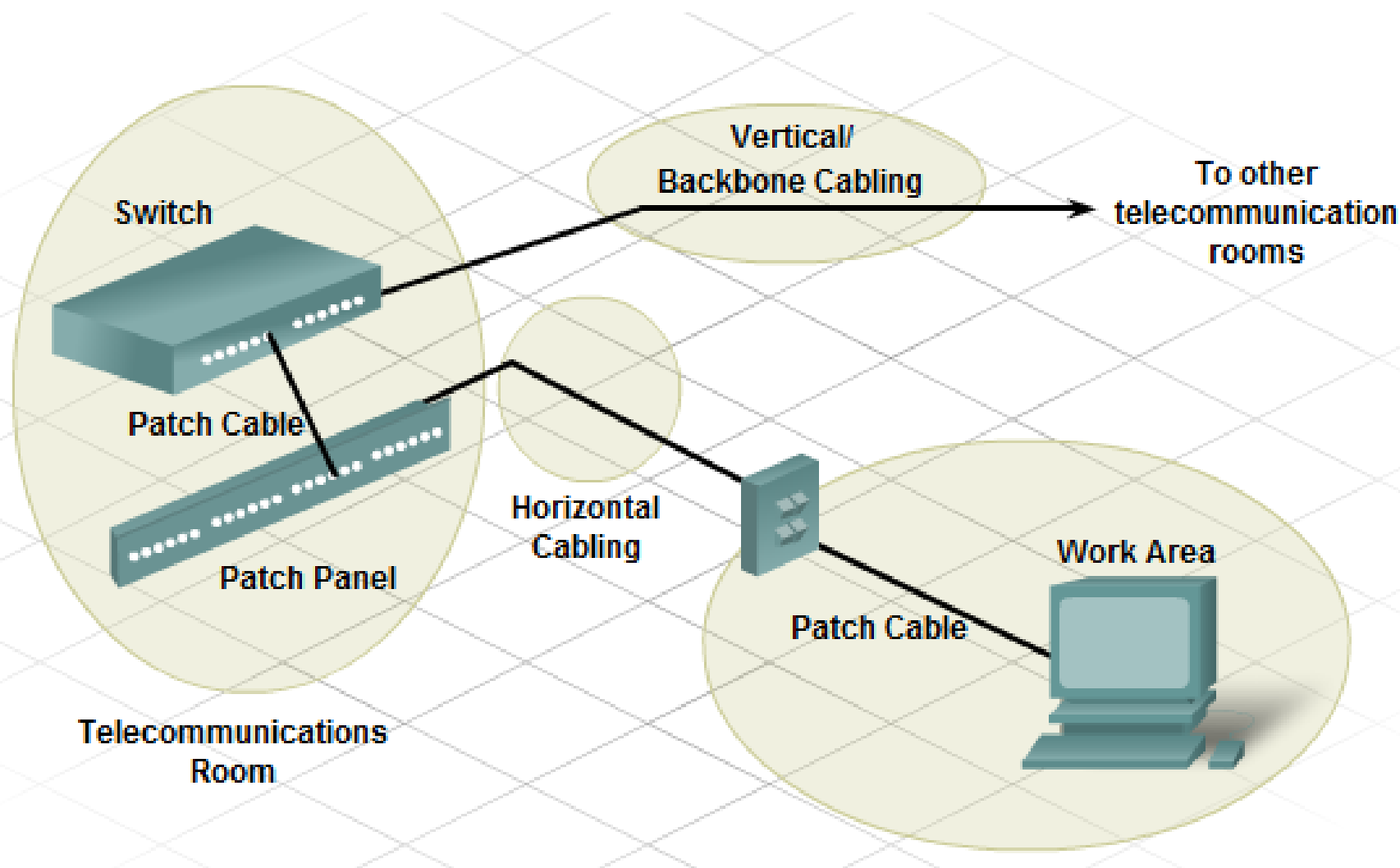
Cabling Considerations

- There are many different types of network cable to choose from, and some are more common than others.
- Shielded Twisted Pair (STP): Usually Category 5, 5e, or 6 cable that has a foil shielding to protect from outside electromagnetic interference (EMI). Distance limitation is approximately 328 feet (100 meters).
- Unshielded Twisted Pair (UTP): Usually Category 5, 5e, or 6 cable does not provide extra shielding from EMI, but it is inexpensive. Cable runs should avoid electrically noisy areas. Distance limitation is approximately 328 feet (100 meters).

Cabling Considerations

- Coaxial: Has a solid copper core with several protective layers including polyvinyl chloride (PVC), braided wire shielding, and a plastic covering. Distance several miles (kilometers) limitations depend on the purpose of the connection.
- Fiber Optic cable: A medium that is not susceptible to EMI, and can transmit data faster and farther than copper. Depending on the type of fiber optics, distance limitations can be several miles (kilometers).

Cabling Considerations



Cabling Considerations

- There are also several organizations in the world that provide LAN cabling specifications.
- The Telecommunications Industry Association (TIA) and the Electronic Industries Alliance (EIA) worked together to provide the TIA/EIA cable specifications for LANs. Two of the most common TIA/EIA cable specifications include the 568-A and 568-B standards. Both of these standards typically use the same Cat 5 or Cat 6 cable, but with a different termination color code.

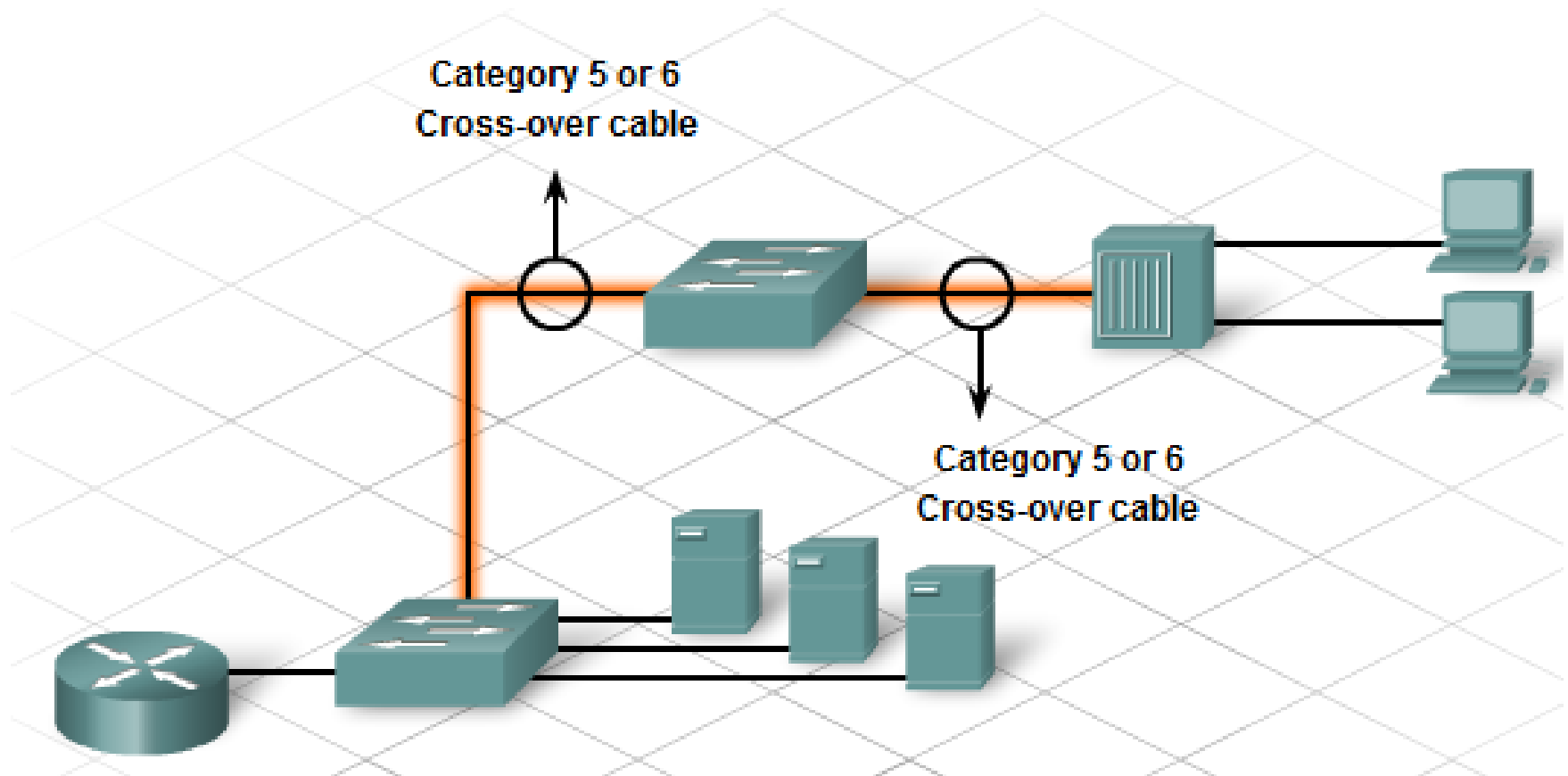
Cabling Considerations

- There are three different types of twisted pair cables that are used in networks:
- Straight-through: Used between dissimilar devices, such as a switch and a computer or a switch and a router
- Crossover: Used between similar devices, such as two switches or two computers
- Console (or Rollover): Used to connect a computer to the console port of a router or switch to do initial configuration

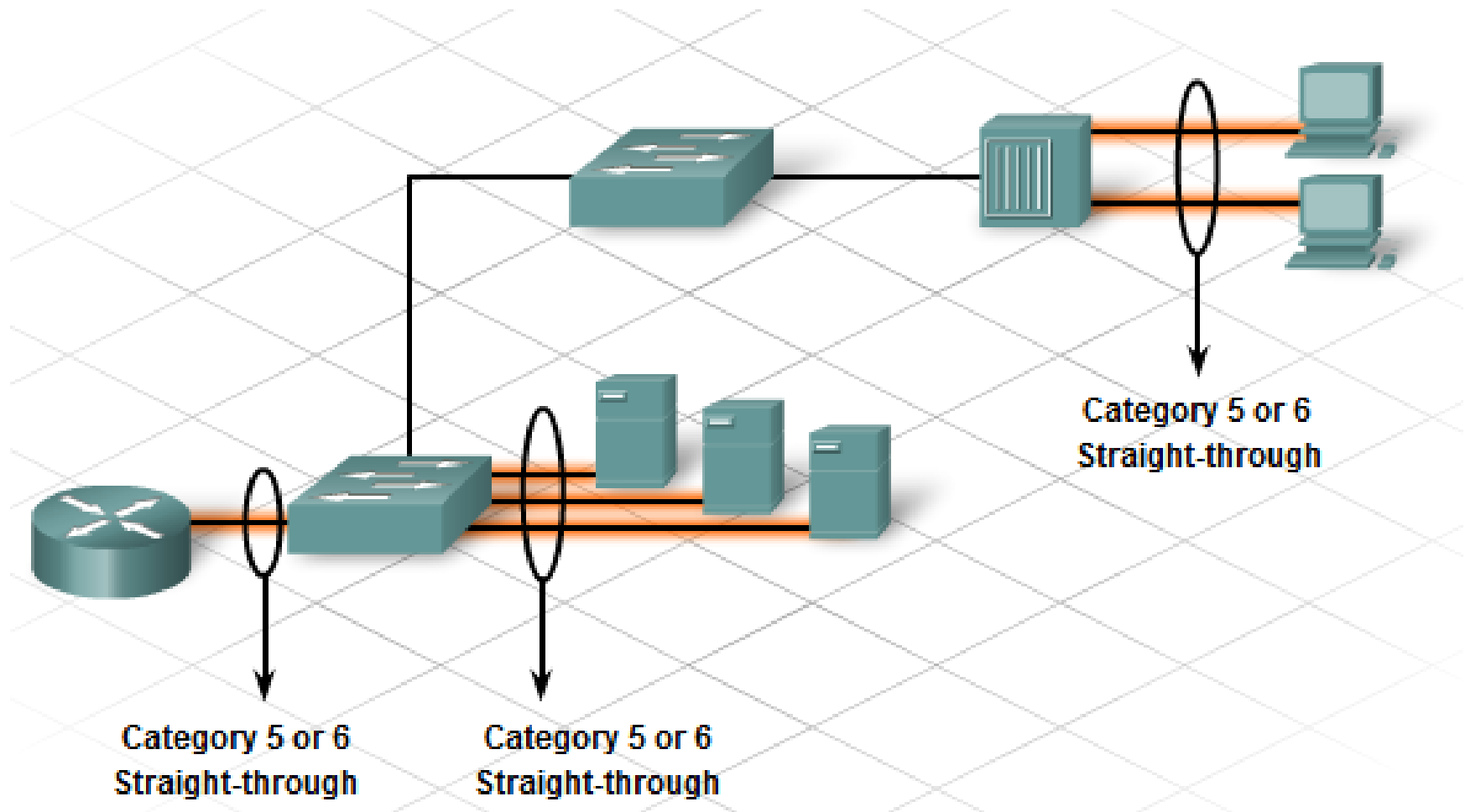
Cabling Considerations

- Another cable type that is common in networks is a serial cable. A serial cable is typically used to connect the router to an Internet connection. This Internet connection may be to the phone company, the cable company, or a private ISP.

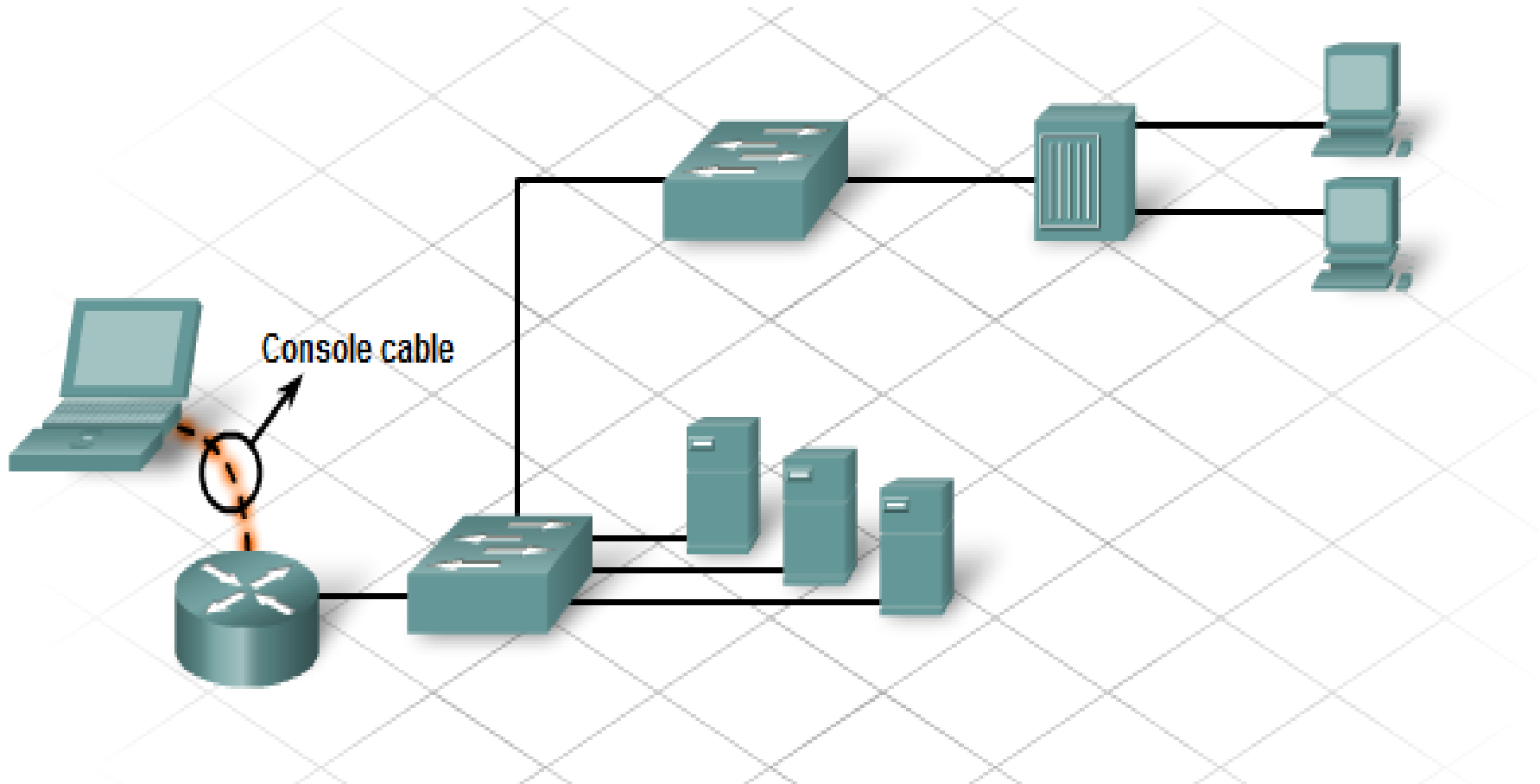
Cabling Considerations



Cabling Considerations



Cabling Considerations

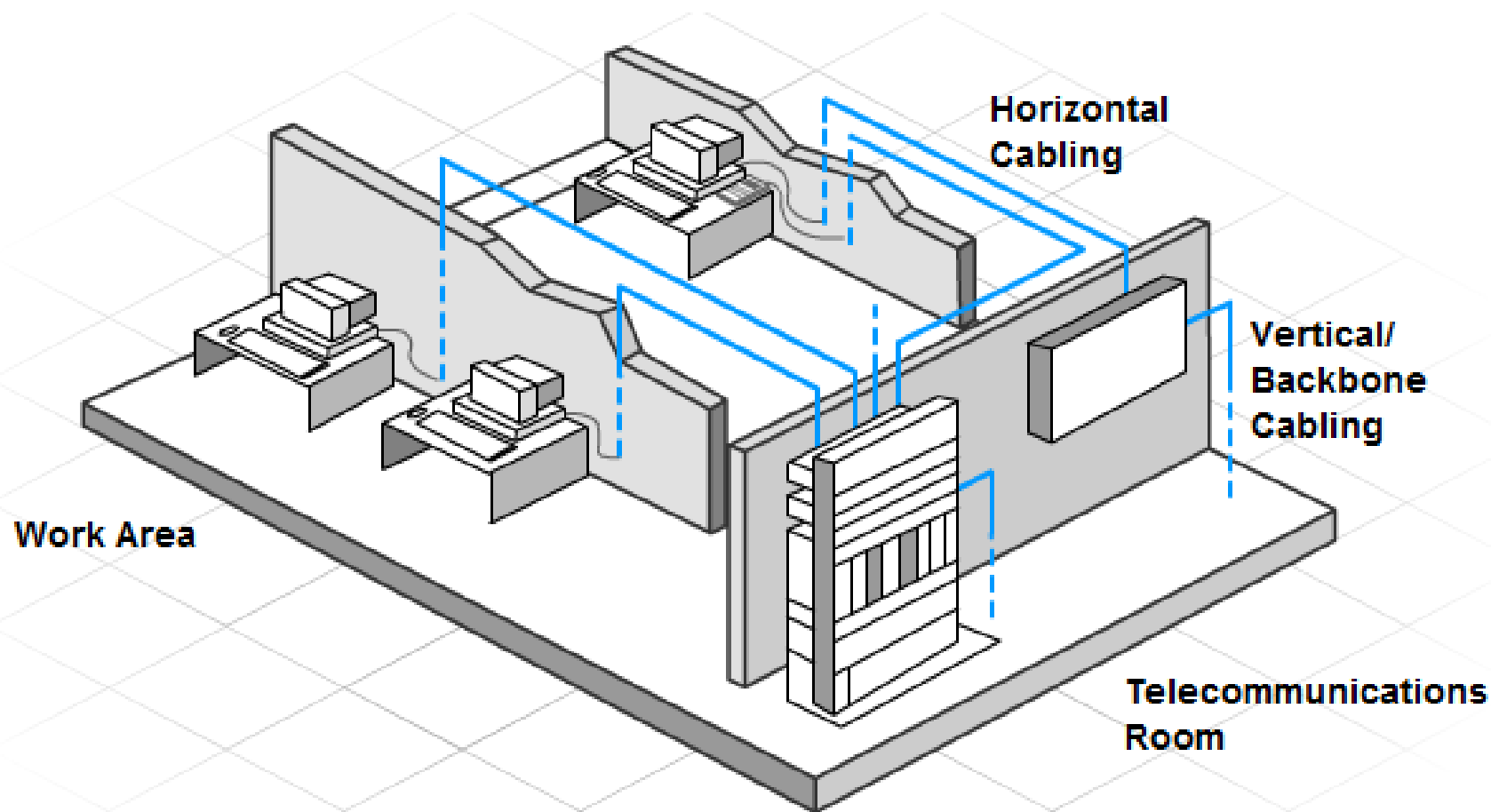


Structured Cable

- When designing a structured cable project, the first step is to obtain an accurate floor plan. The floor plan will allow the technician to identify possible wiring closet locations, identify cable runs, as well as which electrical areas to avoid.
- Once the technician has identified and confirmed the locations of network devices, it is time to draw the network on the floor plan. Some of the more important items to document include the following:

- Patch cables: Short cable from the computer to the wall plate in the user work area
- Horizontal cable: Cable from the wall plate to the IDF in the distribution area
- Vertical cable: Cable from the IDF to the MDF in the organization's backbone area
- Backbone cable: The part of a network that handles the major traffic
- Location of wiring closet: Area to concentrate end user cable to hub or switch

- Cable management system: Series of trays and straps used to guide and protect cable runs
- Cable labeling system: Proper labeling system or scheme to identify cables
- Electrical considerations: Premises should have adequate outlets to support electrical requirements of network equipment.



Purchasing Equipment

- As the ISP team plans the network upgrade, there are issues related to purchasing new equipment, as well as maintenance of new and existing equipment that must be addressed. There are generally two options for the new equipment as follows:

Purchasing Equipment

- **Managed Service:** In this scenario, the equipment would be obtained from the ISP through a lease or some other agreement, and the ISP would be responsible for updates and maintenance of the equipment
- **In-house:** In this scenario, the equipment would be purchased completely by the customer, and the customer would be responsible for updates, warranties, and maintenance of the equipment

Purchasing Equipment

- When purchasing equipment, cost is always a major factor. A good cost analysis of the purchase options will provide a sound basis for the final purchase decision.
- If the managed service is chosen, there will be lease costs, as well as other service costs as outlined in the Service Level Agreement (SLA).

Purchasing Equipment

- If the equipment is purchased outright, the customer should be aware of cost, warranty coverage, compatibility with existing equipment, as well as update and maintenance issues. All of these have a cost, and should be analyzed to determine cost-effectiveness.

Purchasing Equipment

	In-House	Managed Services
Considerations	Requires many decisions <ul style="list-style-type: none"> • Type of equipment • Equipment location • IT organization staffing • Network design • Maintenance requirements • Establishing dial plans 	<ul style="list-style-type: none"> • Initial evaluation and choice of service provider • Requirements definition • Ongoing evaluation of service provider
Costs		
Control and Responsibility		
Reliability		
End-user Experience		

	In-House	Managed Services
Considerations		
Costs	<ul style="list-style-type: none"> • Equipment purchasing or leasing • IT organization staffing • Training costs • Multiple vendor costs and building • Hardware repairs and upgrades • Software release upgrades • Telephone line charges • Redundancy and reliability requirements 	<ul style="list-style-type: none"> • Single, predictable monthly recurring bill • Minimal up front costs
Control and Responsibility		
Reliability		
End-user Experience		

Purchasing Equipment

Considerations

Costs

Control and Responsibility

Reliability

End-user Experience

In-House

- You have most of the control and responsibility for managing and maintaining your network system

Managed Services

- Delegate the level of network management to a qualified service provider, based on your needs
- Keep your core business processes in-house
- Maintain control of workflow in your organization
- Set service-level agreements (SLAs) with a service provider

Considerations

Costs

Control and Responsibility

Reliability

End-user Experience

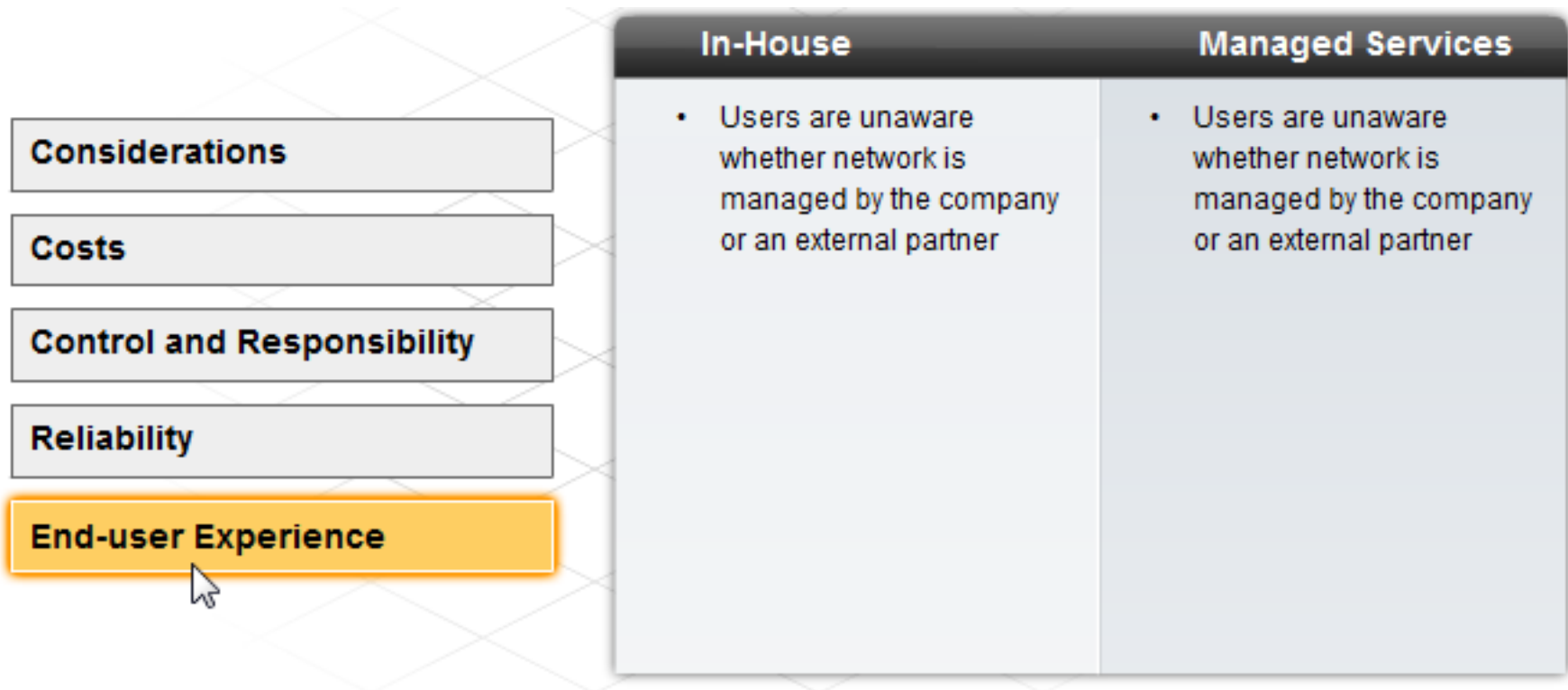
In-House

- You are responsible for keeping your network system available to employees, customers, and partners at all times

Managed Services

- Service providers can guarantee availability up to 99.999 percent
- A 24-hour help desk is available for remote-access users
- Service provider management is transparent to end users

Purchasing Equipment



Selecting Network Devices

- After analyzing requirements, the design staff recommends the appropriate network devices to connect and support the new network functionality.
- Modern networks use a variety of devices for connectivity. Each device has certain capabilities to control the flow of data across a network. A general rule is that the higher the device is in the OSI model, the more intelligent it is. What this means is that a higher-level device can better analyze the data traffic and forward it based on information not available at lower layers.

- As an example, a Layer 1 hub can only forward data out all ports, while a Layer 2 switch can filter the data and only send it out the port connected to the destination based on MAC address.
- As switches and routers evolve, the distinction between them may seem blurred. One simple distinction remains: LAN switches provide connectivity within organizations' local area networks, while routers are needed to interconnect local networks and in a wide-area network environment.

- In addition to switches and routers, there are other connectivity options available for LANs. Wireless access points allow computers and other devices, such as handheld Internet Protocol (IP) phones, to wirelessly connect to the network or share broadband connectivity.

- Firewalls guard against network threats and provide application security, network control and containment, and secure connectivity technologies. ISRs combine the functionality of switches, routers, access points and firewalls into the same networking device.



Selecting LAN Devices

- Although both a hub and a switch can provide connectivity at the access layer of a network, switches should be chosen for connecting devices to a LAN. Switches are more expensive than hubs, but the enhanced performance makes it cost effective. A hub is generally only chosen as a networking device within a very small LAN, a LAN that requires little throughput requirements, or when finances are limited.

Selecting LAN Devices

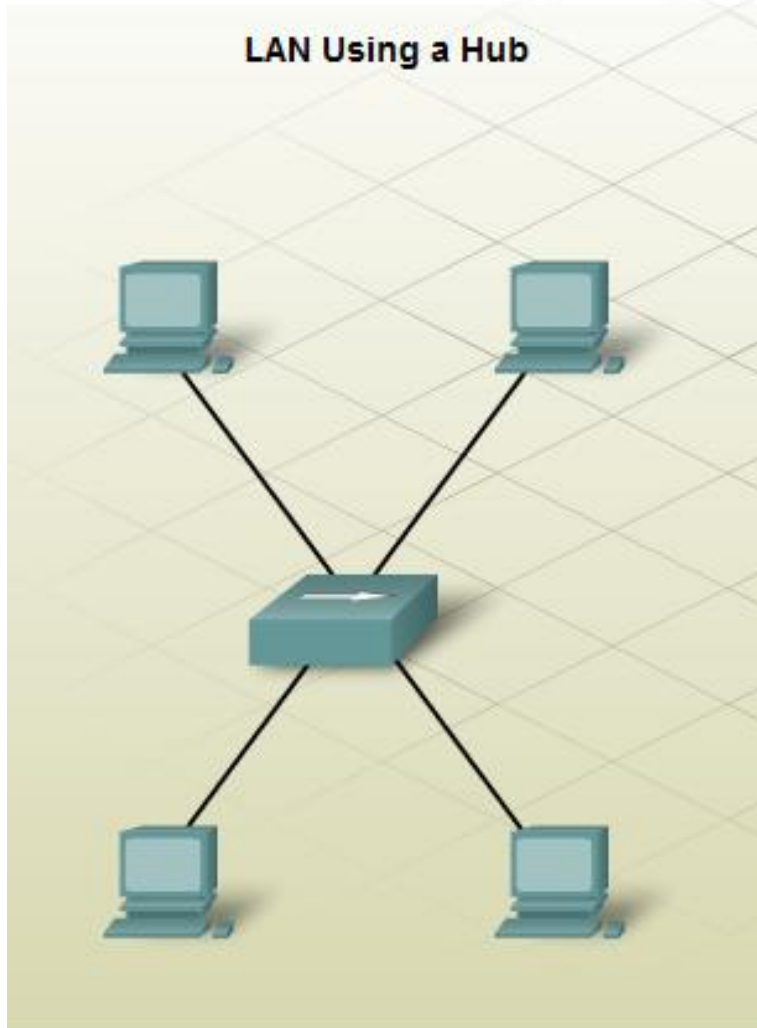
- When selecting the switch for a particular LAN, there are a number of factors that need to be considered. These factors include, but are not limited to:
 - Speed and types of ports/interfaces
 - Expandability
 - Manageability
 - Cost

Selecting LAN Devices

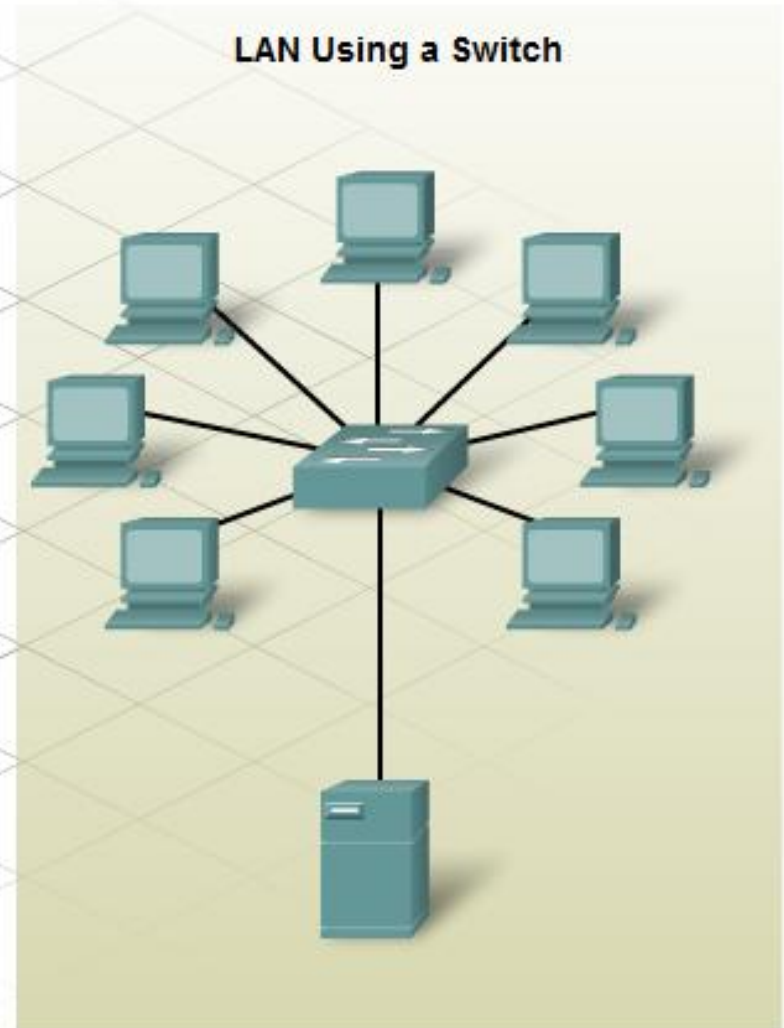
- Speed and Types of Ports/Interfaces
- Choosing Layer 2 devices that can accommodate increased speeds allows the network to evolve without replacing the central devices.
- When selecting a switch, choosing the number and type of ports is a critical decision.
- Network designers should consider carefully how many UTP and/or fiber ports are needed. It is also important to estimate how many more ports will be required to support network expansion.

Selecting LAN Devices

LAN Using a Hub



LAN Using a Switch



Selecting LAN Devices

- Expandability
- Networking devices come in both fixed and modular physical configurations. Fixed configurations have a specific number and type of ports or interfaces. Modular devices have expansion slots that provide the flexibility to add new modules as requirements evolve. Most modular devices come with a basic number of fixed ports as well as expansion slots.

Selecting LAN Devices

- Manageability
- A managed switch provides control over individual ports or over the switch as a whole. Typical controls include the ability to monitor operation and change the settings for a device. A managed device can be monitored for performance and security, and typically provides enhancements to the monitoring and security features.

Selecting LAN Devices

- A typical use of an expansion slot would be to add fiber-optic modules to a device that was originally configured with a number of fixed UDP ports. Modular switches can be a cost-effective approach to scaling LANs.



Type of
Ports



Speed
Required



Expandability

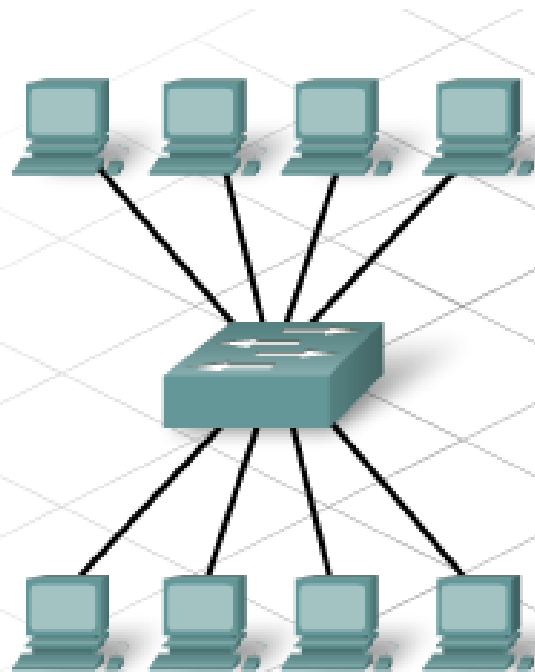


Manageability

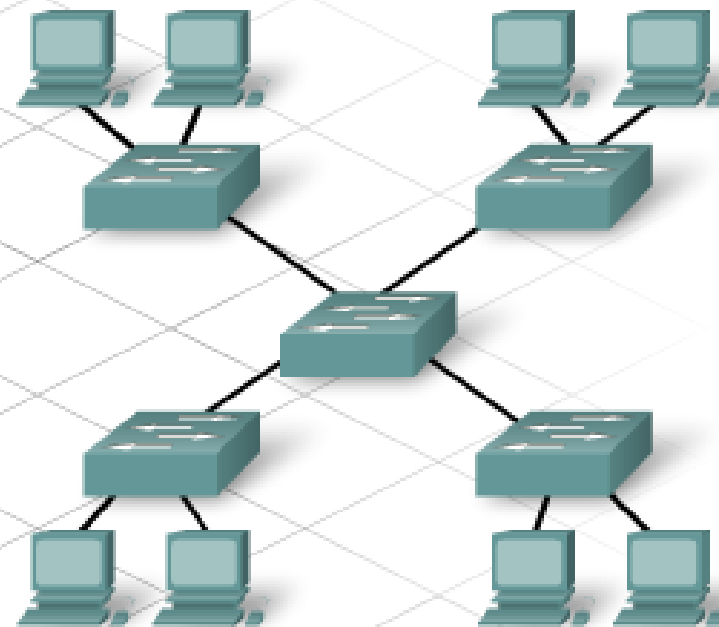
- Cost
- The cost of a switch is determined by its capacity and features. The switch capacity includes the number and types of ports available and the overall throughput. Other factors that impact the cost are its network management capabilities, embedded security technologies, and optional advanced switching technologies.

- Using a simple cost per port calculation, it may appear initially that the best option is to deploy one large switch at a central location. However, this apparent cost savings may be offset by the expense from the longer cable lengths required to connect every device on the LAN to one switch. This option should be compared with the cost of deploying a number of smaller switches connected by a few long cables to a central switch.

- Deploying a number of smaller devices, instead of a single large device, also has the benefit of reducing the size of the failure domain. A failure domain is the area of the network affected when a piece of networking equipment malfunctions or fails.
- Once the LAN switches are selected, determine which router is appropriate for the customer.



One large, central switch



Multiple switches, connected with a central switch

Selecting Internetworking Devices

- A router is a Layer 3 device. It performs all tasks of devices in lower layers and selects the best route to the destination based on Layer 3 information. Routers are the primary devices used to interconnect networks. Each port on a router connects to a different network and routes packets between the networks. Routers have the ability to break up broadcast domains and collision domains.

Selecting Internetworking Devices

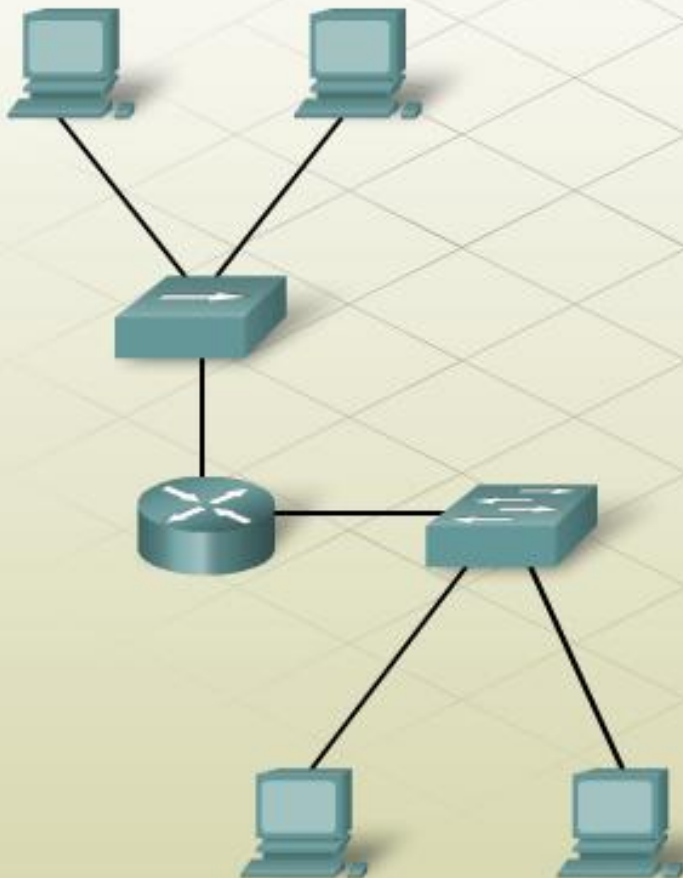
- When selecting a router, it is necessary to match the characteristics of the router to the requirements of the network. Factors for choosing a router include:
 - Type of connectivity required
 - Features available
 - Cost

Selecting Internetworking Devices

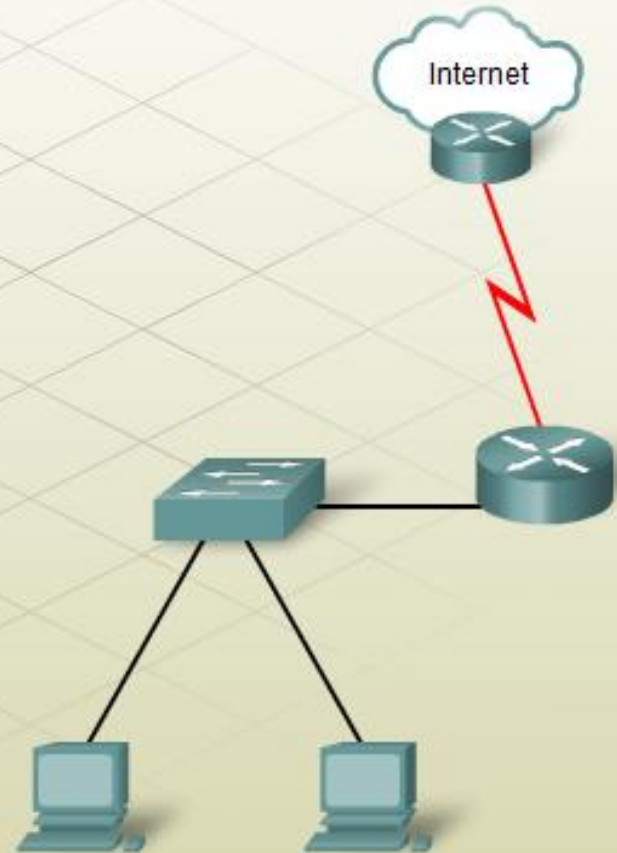
- Connectivity
- Routers are used to interconnect networks that use different technologies. They can have both LAN and WAN interfaces.
- The router's LAN interfaces connect to the LAN media. The media is typically UTP cabling, but modules can be added for using fiber-optics as well. Depending on the series or model of router, there can be multiple interface types for connection of LAN and WAN cabling.

Selecting Internetworking Devices

Router Interconnecting Two LANs



Router Interconnecting a LAN and a WAN



Selecting Internetworking Devices

- Features
- It is necessary to match the characteristics of the router to the requirements of the network. After analysis, the business may need a router with specific features. In addition to basic routing, features include:
- Security
- Quality of Service (QoS)
- Voice over IP (VoIP)
- Network Address Translation (NAT)
- Dynamic Host Configuration Protocol (DHCP)

Selecting Internetworking Devices

- Cost
- When selecting internetwork devices, budget is an important consideration. Routers can be expensive. Additional modules, such as fiber-optics, can increase the costs. The media used to connect to the router should be supported without the purchase of additional modules. This keeps costs to a minimum.

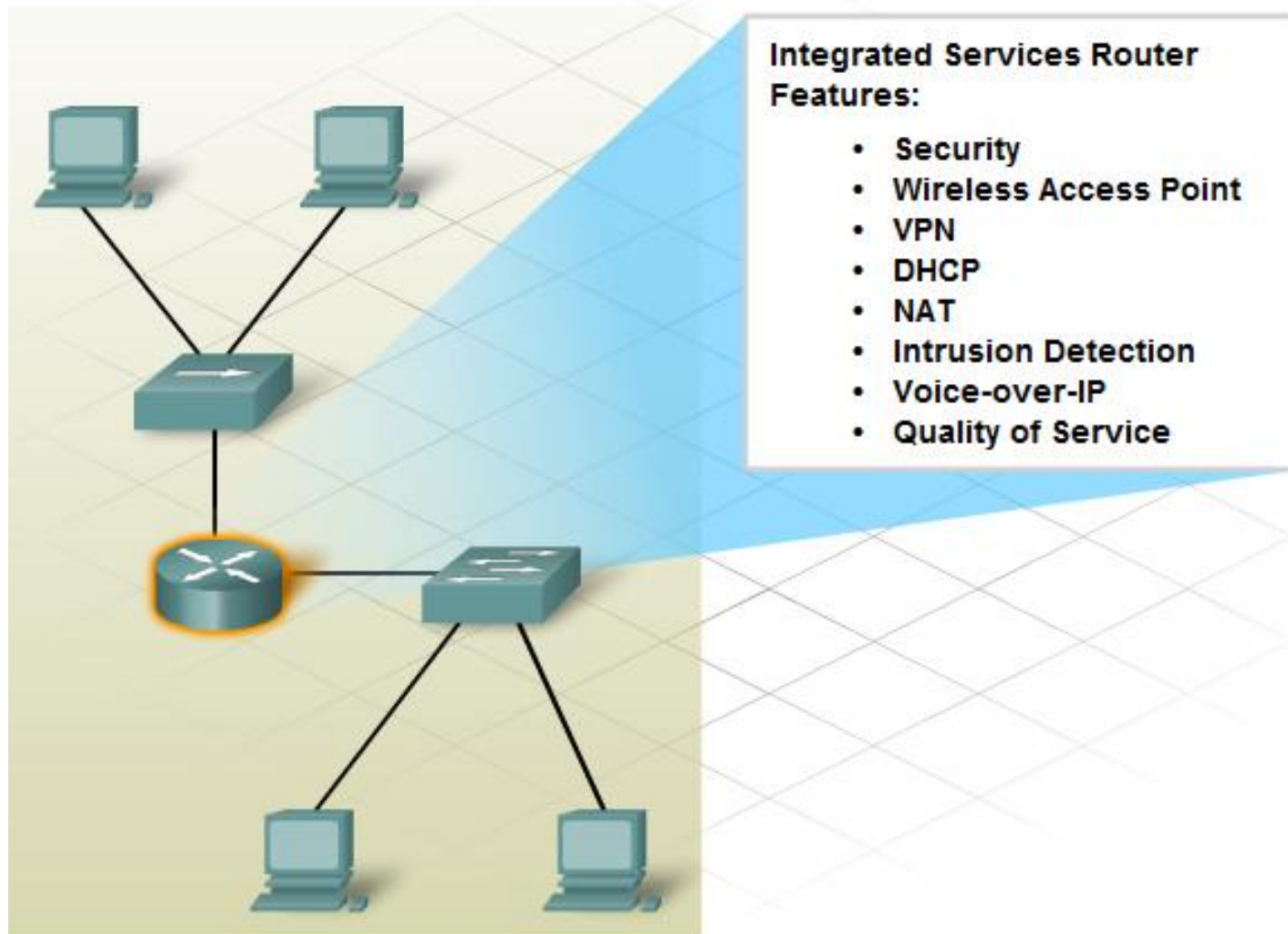
Selecting Internetworking Devices

- An Integrated Service Router (ISR) is a relatively new technology that combines multiple services into one device. Before the ISR, multiple devices were required to meet the needs of data, wired and wireless, voice and video, firewall, and VPN technologies. The ISR was designed with multiple services to accommodate the demands of small to medium size businesses and branch offices of large organizations.

Selecting Internetworking Devices

- An ISR is designed for ease of use. It can quickly and easily enable end-to-end protection for users, applications, network endpoints, and wireless LANs. The cost of an ISR can be less than if the individual devices were purchased separately.

Selecting Internetworking Devices



Network Equipment Upgrade

- Many small networks were initially built using a low-end integrated router to connect the wireless and wired users. This device is designed to support small networks, usually consisting of a few wired hosts and possibly four or five wireless devices. When a small business outgrows capabilities of their existing network devices, it is necessary to upgrade to more capable devices.

Network Equipment Upgrade

- Examples that are used within this course include:
- Cisco 1841 ISR
- Cisco 2960 Switch
- The Cisco 1841 is designed to be a branch office or medium-sized business router. As an entry-level multi-service router, it offers a number of different connectivity options. It is modular in design and can deliver multiple security services.

Network Equipment Upgrade



Cisco 1841 ISR



Cisco 2960 Switch

Network Equipment Upgrade

- The Cisco Catalyst 2960 Series Intelligent Ethernet Switches are a family of fixed-configuration, stand-alone devices that provide Fast Ethernet and Gigabit Ethernet connectivity to the desktop. Some of the features of the Catalyst 2960 series of switches are:

Network Equipment Upgrade

- Offers entry-level, enterprise-class, fixed-configuration switching optimized for access layer deployments
- Fast Ethernet and Gigabit Ethernet to the desktop configurations
- Ideal for entry-level enterprise, mid-market, and branch-office environments
- Compact switches for deployments outside the wiring closet

Network Equipment Upgrade

- These switches can provide the high speeds and high density switching capabilities that the smaller ISRs with integrated switching cannot. They are therefore a good option when upgrading networks built with either hubs or small ISR devices.

Cisco Catalyst 2960 Series Intelligent Ethernet Switches



Reliability and availability

- Purchasing network devices and installation of cabling for a network upgrade is only the beginning. Networks must also be reliable and available. Reliability is usually achieved by adding redundant components to the network, such as two routers instead of one. In this case, alternate data paths are created, so if one router is experiencing problems, the data can take an alternate route to arrive at the destination.

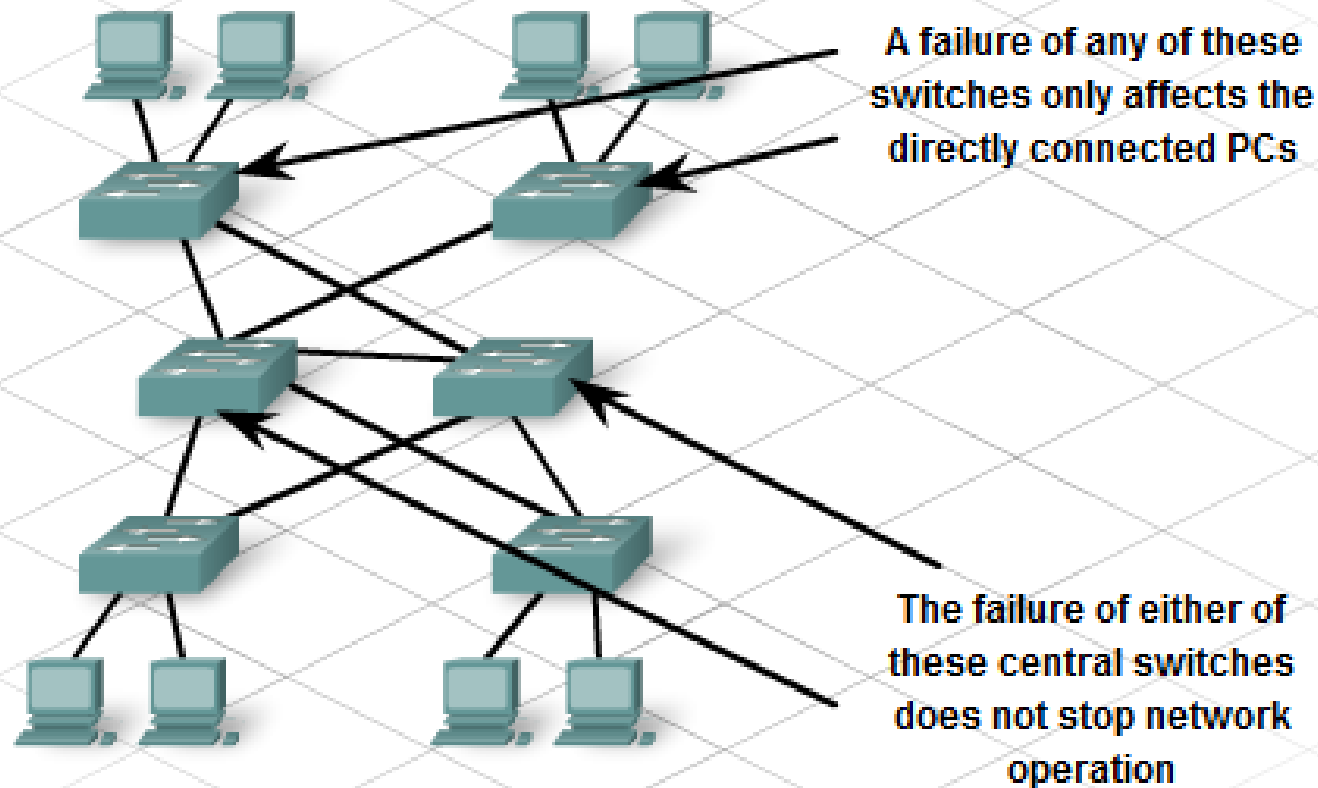
Reliability and availability

- An increase in reliability improves availability. As an example, telephone systems require five-9s of availability. This means that the telephone system must be available 99.999% of the time. Telephone systems cannot be down, or unavailable, for more than .001% of the time.

Reliability and availability

- Fault tolerance systems are typically used to improve network reliability. Fault tolerance systems include devices such as uninterruptible power supplies (UPS), multiple AC power supplies, hot-swappable devices, and multiple interface cards. When one device fails, the redundant or backup system will take over to ensure minimal loss of reliability.

Reliability and availability



Two central switches with redundancy

Reliability and availability

- IP Addressing Plan
- Planning for the network installation must include planning the logical addressing. Changing the Layer 3 IP addressing is a major issue when upgrading a network. If the structure of the network is going to be changed in the upgrade, the IP address scheme and network information may need to be altered.

Reliability and availability

- Consideration must be given to every device that requires an IP address, now and in the future. The hosts and network devices that require an IP address include:
 - User computers
 - Administrator computers
 - Servers
 - Other end devices such as printers, IP phones, and IP cameras
 - Router LAN interfaces
 - Router WAN (serial) interfaces

Reliability and availability

- There are also devices that might need an IP address in order to access and manage them. These include:
- Stand-alone switches
- Wireless Access Points
- For example, if a new router is introduced to the network, new local networks, or subnets, will be created. These new subnets will need to have the proper IP address and subnet mask calculated. Sometimes, this means having to assign a totally new addressing scheme on the network.

Reliability and availability

- For example, if a new router is introduced to the network, new local networks, or subnets, will be created. These new subnets will need to have the proper IP address and subnet mask calculated. Sometimes, this means having to assign a totally new addressing scheme on the network.
- Once all of the planning and design phases are complete, the upgrade proceeds to the implementation phase, in which the actual network installation begins.

Reliability and availability



Router Interfaces

Count the number of interfaces, and not the number of routers



Printers



IP Phones

Count other specialty IP devices as well



Switch Management Addresses



Administration Users



General Users



Servers

Summary

- A network technician must perform a site survey to document the existing network structure before a network upgrade can be planned.
- Documentation to include a physical and logical topology map and an inventory sheet of all equipment.
- Gather customer network requirements through surveys and interviews.
- If a network upgrade is necessary, a plan should be in place, with consideration of the strengths, weaknesses, opportunities, or threats (SWOT) of the network installation.
- There are five phases of a network upgrade: requirements gathering, selection and design, implementation, operation, and review and evaluation.
- Examining the network facilities includes the physical environment, the telecommunication rooms (MDF and IDF), as well as existing network wiring.

Summary

- When cabling, there are four physical areas to consider: work area, distribution area, telecommunications room area, and the backbone area.
- When determining cabling needs, it is necessary to keep in mind the work area, the type of cable used, and the purpose of the cable.
- Structured cabling projects deal with the placement of cables, the location of wiring closets, cable management, and electrical considerations.
- When new equipment is used for network upgrade, there are two purchase options: managed service and in-house customer purchased.
- A device that functions at higher OSI layers is generally considered a more intelligent device.
- When upgrading network devices, cost and expandability are important factors to consider.