



Chapter 11: It's a Network



Network Basics

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Chapter 11

- 11.0 Introduction
- 11.1 Create and Grow
- 11.2 Keeping the Network Safe
- 11.3 Basic Network Performance
- 11.4 Managing IOS Configuration Files
- 11.5 Summary



Chapter 11: Objectives

Upon completion of this chapter, you will be able to:

- Identify the devices and protocols used in a small network.
- Explain how a small network serves as the basis of larger networks.
- Explain the need for basic security measures on network devices.
- Identify security vulnerabilities and general mitigation techniques.
- Use the output of **ping** and **tracert** commands to establish relative network performance.
- Use basic show commands to verify the configuration and status of a device interface.



Chapter 11: Objectives (Cont.)

- Use the basic **host** commands to acquire information about the devices in a network.
- Explain the file systems on Routers and Switches.
- Apply the commands to back up and restore an IOS configuration file.



11.1 Create and Grow



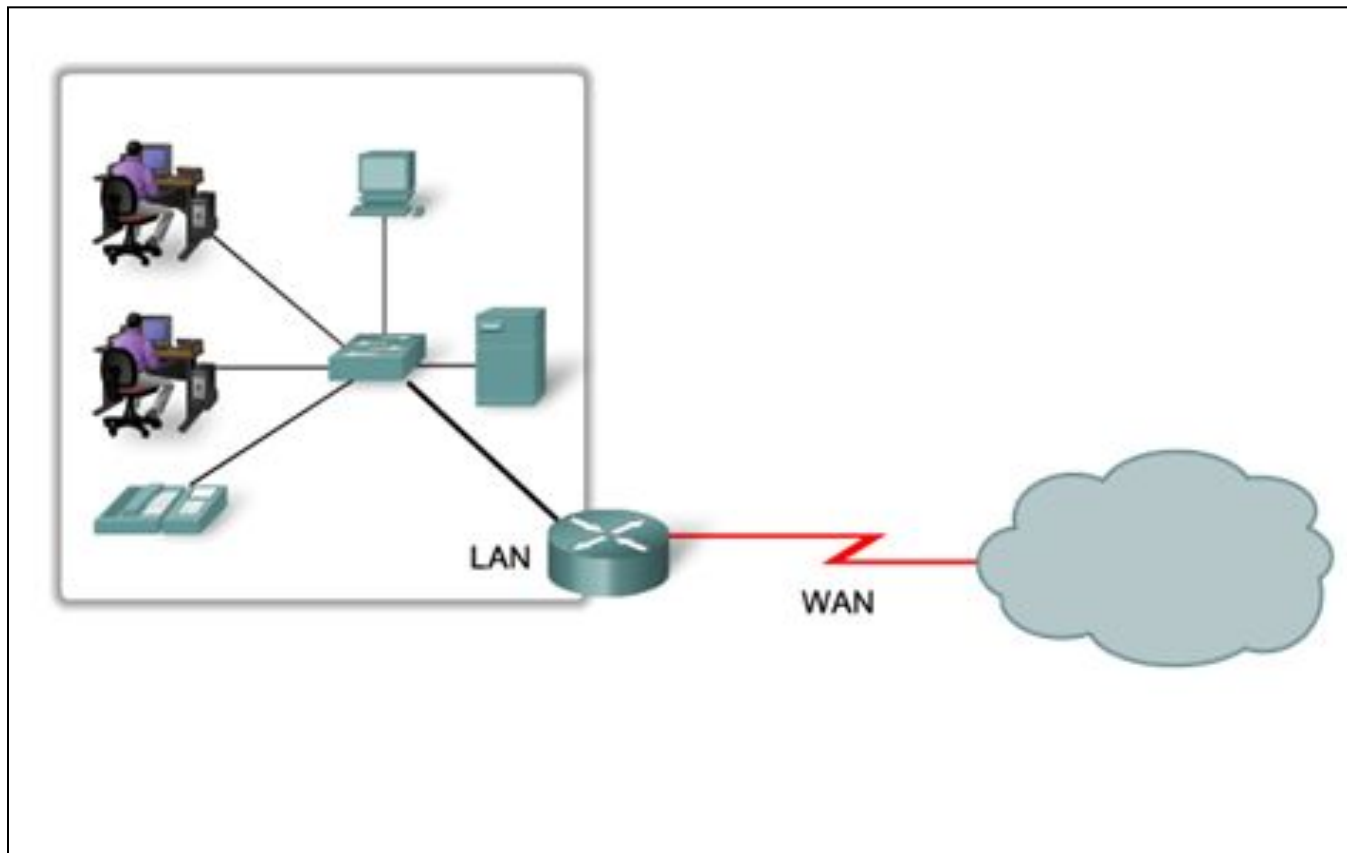
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Devices in a Small Network

Small Network Topologies

Typical, Small Network Topology





Devices in a Small Network

Device Selection for a Small Network

Factors to be considered when selecting intermediate devices.



COST



PORTS



SPEED



EXPANDABLE/ MODULAR



MANAGEABLE



Devices in a Small Network

Addressing for a Small Network

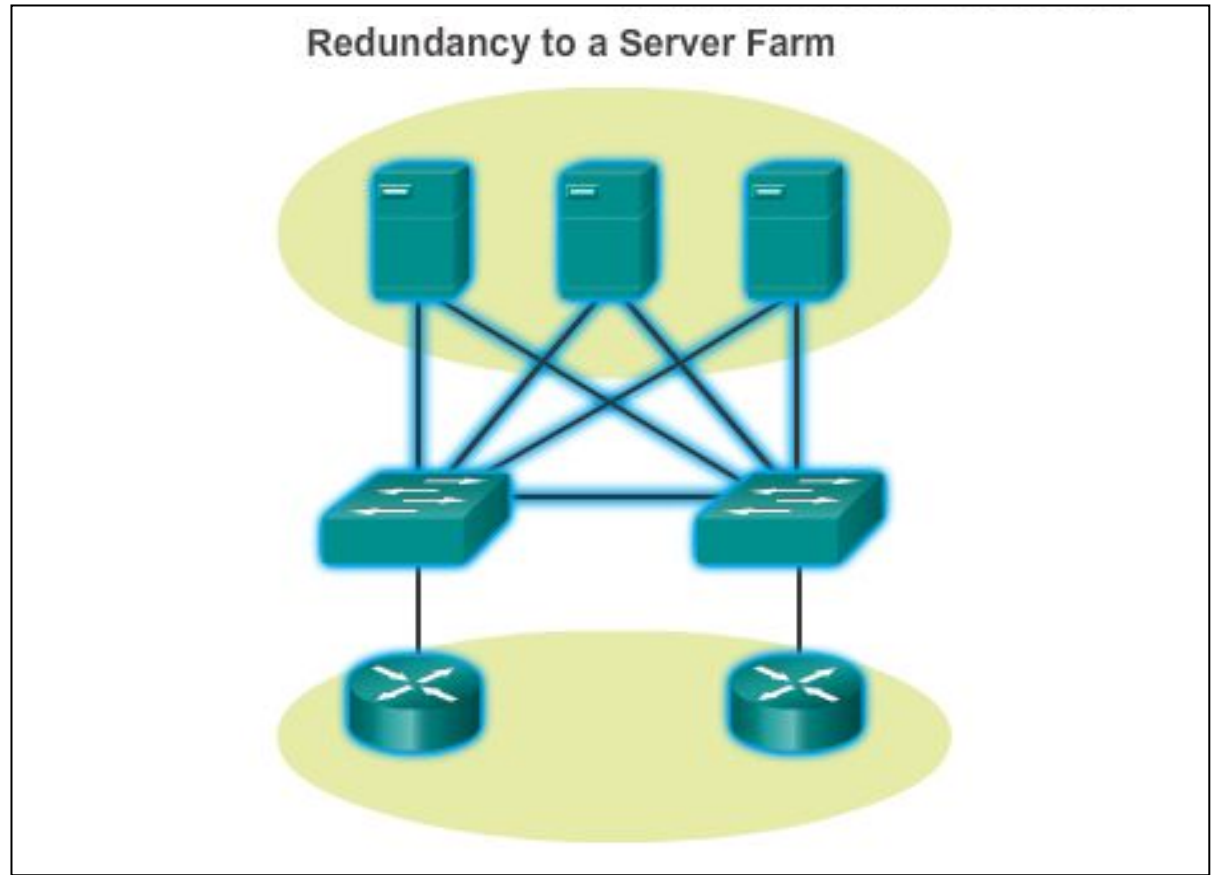
- IP addressing scheme should be planned, documented, and maintained based on the type of devices receiving the address.
- Examples of devices that should be part of the IP design:
 - End devices for users
 - Servers and peripherals
 - Hosts that are accessible from the Internet
 - Intermediary devices
- Planned IP schemes help the administrator:
 - Track devices and troubleshoot
 - Control access to resources



Devices in a Small Network

Redundancy in a Small Network

- Redundancy helps to eliminate single points of failure.
- Improves the reliability of the network.

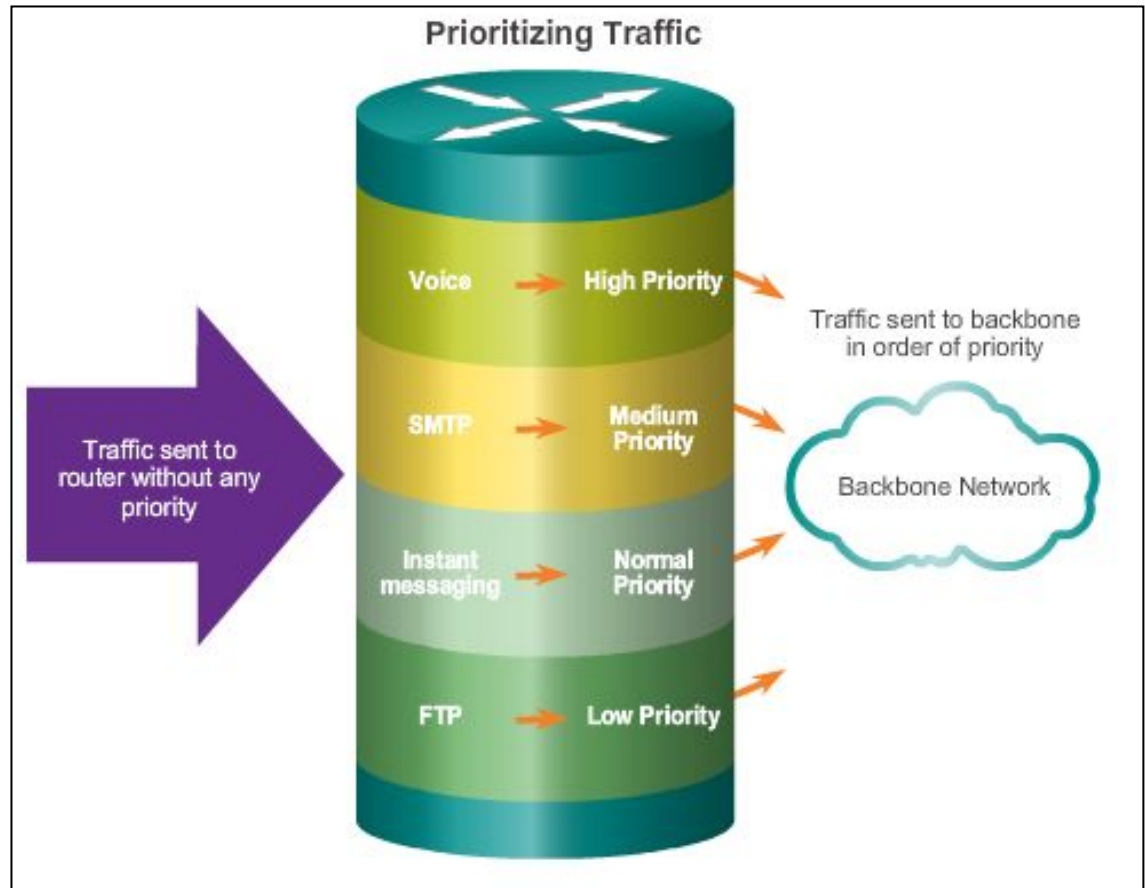




Devices in a Small Network

Design Considerations for a Small Network

- The following should be included in the network design:
 - Secure file and mail servers in a centralized location.
 - Protect the location by physical and logical security measures.
 - Create redundancy in the server farm.
 - Configure redundant paths to the servers.





Protocols in a Small Network

Common Applications in a Small Network

- **Network-Aware Applications** – Software programs used to communicate over the network.
- **Application Layer Services** – Programs that interface with the network and prepare the data for transfer.

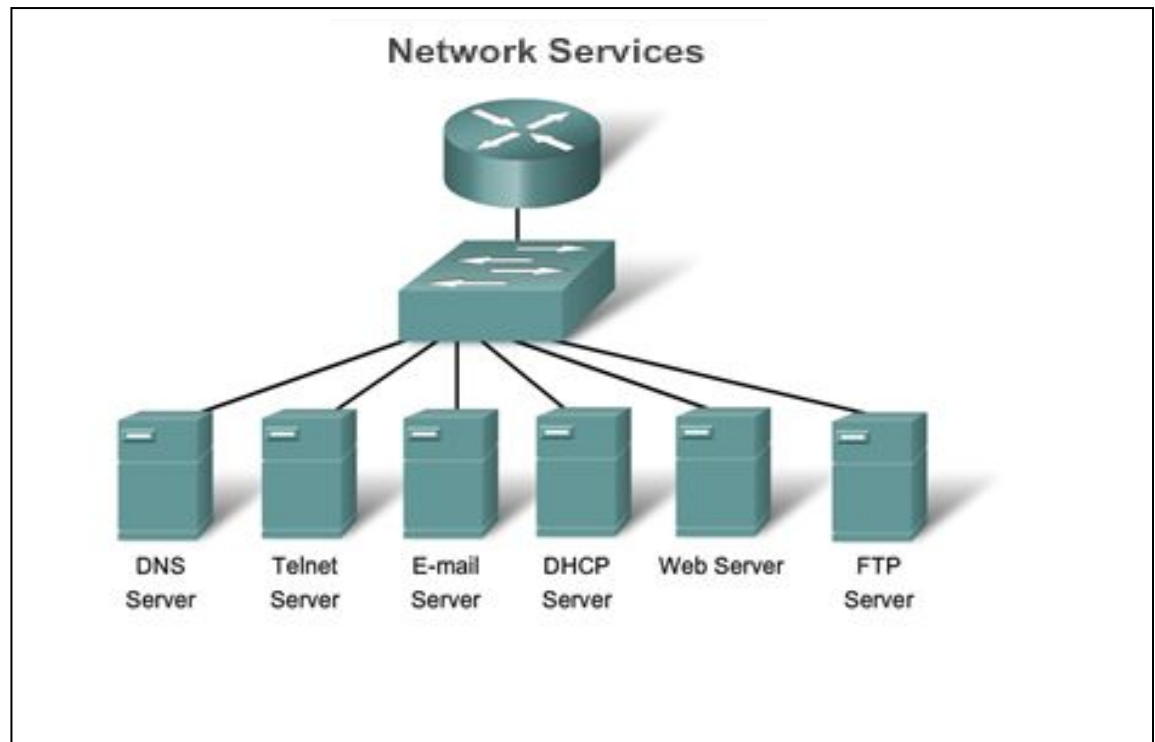


Protocols in a Small Network

Common Protocols in a Small Network

Network protocols define:

- Processes on either end of a communication session
- Types of messages
- Syntax of the messages
- Meaning of informational fields
- How messages are sent and the expected response
- Interaction with the next lower layer





Protocols in a Small Network

Real-Time Applications for a Small Network

- **Infrastructure** – Should be evaluated to ensure it supports proposed real-time applications.
- **VoIP** – Is implemented in organizations that still use traditional telephones.
- **IP telephony** – The IP phone performs voice-to-IP conversions.
- **Real-time video protocols** – Use the Time Transport Protocol (RTP) and the Real-Time Transport Control Protocol (RTCP).



Growing to Larger Networks

Scaling a Small Network

Important considerations when growing to a larger network:

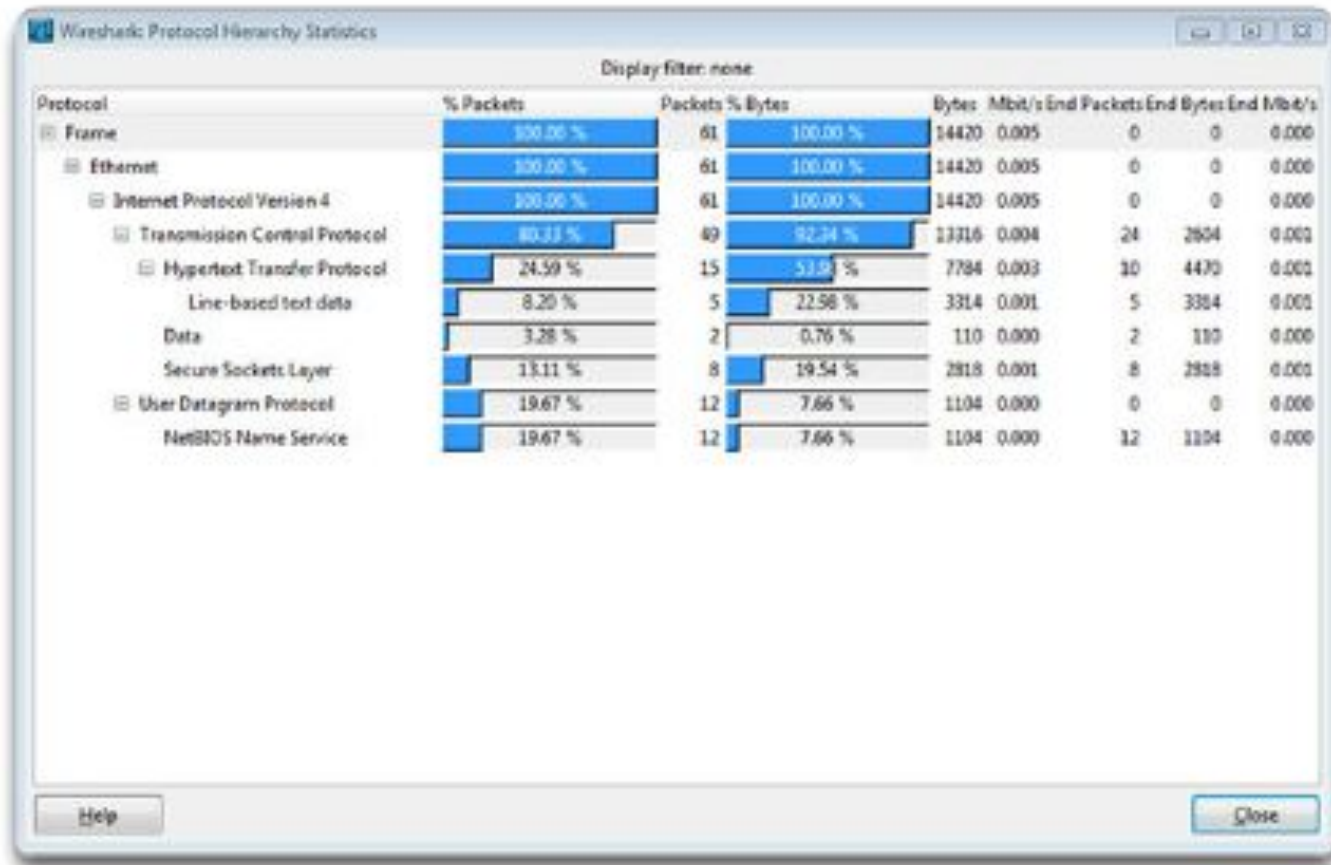
- **Documentation** – Physical and logical topology.
- **Device inventory** – List of devices that use or comprise the network.
- **Budget** – Itemized IT budget, including fiscal year equipment purchasing budget.
- **Traffic Analysis** – Protocols, applications, services, and their respective traffic requirements should be documented.



Growing to Larger Networks

Protocol Analysis of a Small Network

Information gathered by protocol analysis can be used to make decisions on how to manage traffic more efficiently.





Growing to Larger Networks

Evolving Protocol Requirements

- Network administrator can obtain IT “snapshots” of employee application utilization.
- Snapshots track network utilization and traffic flow requirements.
- Snapshots help inform network modifications needed to optimize employee productivity.

Software Processes

Processes are individual software programs running concurrently.

Processes can be:

- 1 Applications
- 2 Services
- 3 System operations
- 4 One program may be running several times, each in its own process.

Image Name	User Name	CPU	Mem Usage
Apoinf.exe	frances	00	5,288 K
csrss.exe	frances	00	1,920 K
EXCEL.EXE	frances	00	2,000 K
quartz.exe	frances	00	4,244 K
DSentry.exe	frances	00	1,940 K
Directod.exe	frances	00	5,540 K
wdfmgr.exe	LOCAL SERVICE	00	1,716 K
svchost.exe	LOCAL SERVICE	00	4,304 K
alg.exe	LOCAL SERVICE	00	3,512 K
scardsvr.exe	LOCAL SERVICE	00	2,564 K
svchost.exe	NETWORK SERVICE	00	3,744 K
svchost.exe	NETWORK SERVICE	00	4,440 K
msdtc.exe	NETWORK SERVICE	00	4,852 K
System Idle Process	SYSTEM	96	16 K
System	SYSTEM	00	224 K
svchost.exe	SYSTEM	00	5,152 K
ViewpointService....	SYSTEM	00	2,208 K
WLTRYSVC.EXE	SYSTEM	00	1,368 K
WZCRES.S.exe	SYSTEM	00	1,092 K

Processes: 64 CPU Usage: 4% Commit Charge: 507M / 2461M



11.2 Keeping the Network Safe



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Network Device Security Measures

Categories of Threats to Network Security

Categories of Threats to Network Security



Information Theft



Data Loss and Manipulation



Identity Theft



Disruption of Service



Network Device Security Measures

Physical Security

Four classes of physical threats are:

- **Hardware threats** – Physical damage to servers, routers, switches, cabling plant, and workstations.
- **Environmental threats** – Temperature extremes (too hot or too cold) or humidity extremes (too wet or too dry).
- **Electrical threats** – Voltage spikes, insufficient supply voltage (brownouts), unconditioned power (noise), and total power loss.
- **Maintenance threats** – Poor handling of key electrical components (electrostatic discharge), lack of critical spare parts, poor cabling, and poor labeling.



Network Device Security Measures

Types of Security Vulnerabilities

Vulnerabilities - Technology

Types of Security Weaknesses:

- Technological
- Configuration
- Security policy

Network security weaknesses:

TCP/IP protocol weakness

- Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP) and Internet Control Message Protocol (ICMP) are inherently insecure.
- Simple Network Management Protocol (SNMP) and Simple Mail Transfer Protocol (SMTP) are related to the inherently insecure structure upon which TCP was designed.

Operating system weakness

- Each operating system has security problems that must be addressed.
- UNIX, Linux, Mac OS, Mac OS X, Windows Server 2012, Windows 7, Windows 8
- They are documented in the Computer Emergency Response Team (CERT) archives at <http://www.cert.org>.

Network equipment weakness

Various types of network equipment, such as routers, firewalls, and switches have security weaknesses that must be recognized and protected against. Their weaknesses include password protection, lack of authentication, routing protocols, and firewall holes.



Vulnerabilities and Network Attacks

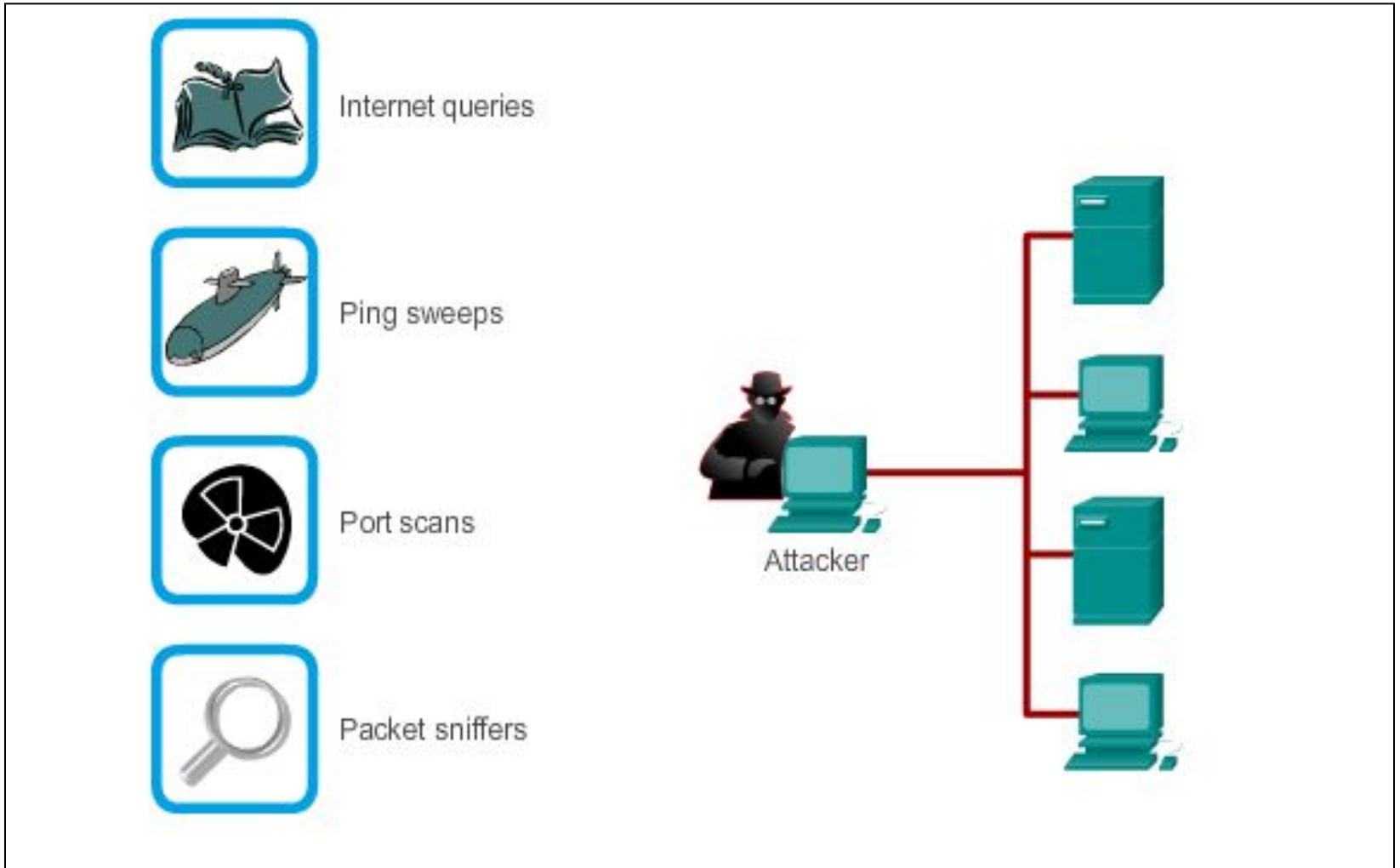
Viruses, Worms, and Trojan Horses

- **Virus** – Malicious software that is attached to another program to execute a particular unwanted function on a workstation.
- **Trojan horse** – An entire application written to look like something else, when in fact it is an attack tool.
- **Worms** – Worms are self-contained programs that attack a system and try to exploit a specific vulnerability in the target. The worm copies its program from the attacking host to the newly exploited system to begin the cycle again.



Vulnerabilities and Network Attacks

Reconnaissance Attacks





Vulnerabilities and Network Attacks

Access Attacks

Password Attack

Attackers can implement password attacks using several different methods:

- Brute-force attacks
- Trojan horse programs
- Packet sniffers

?
X

Authorization

Username

Password

Connect

Options

Cancel

Help

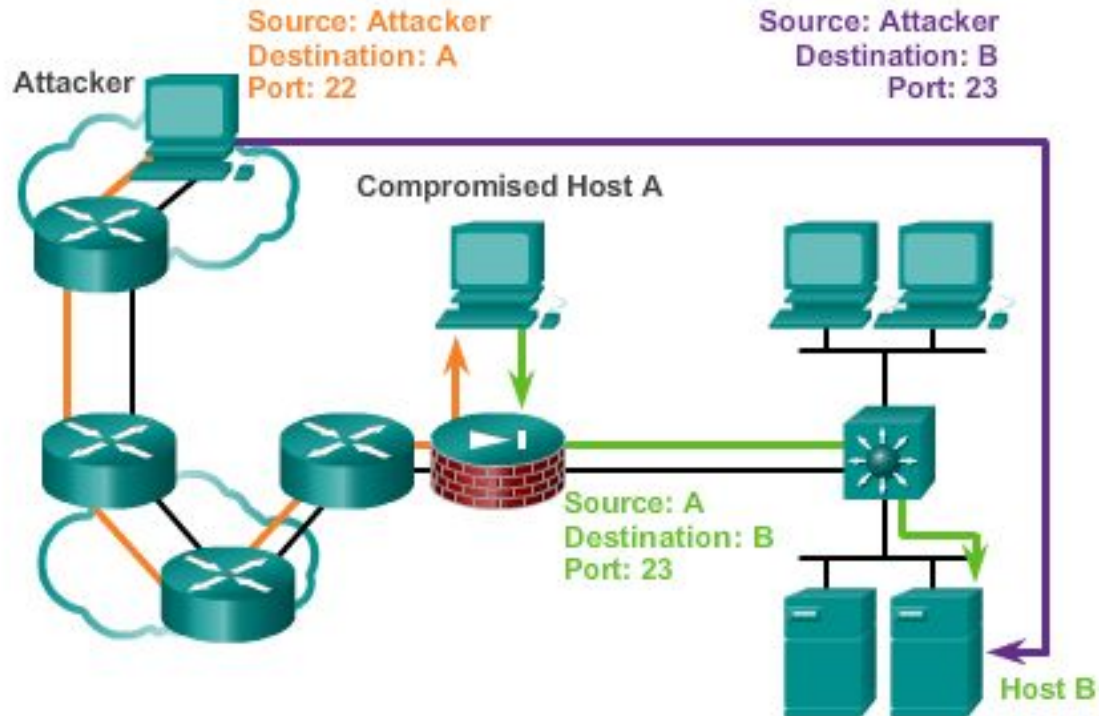


Vulnerabilities and Network Attacks

Access Attacks (Cont.)

Port Redirection

Port redirection is a type of trust-exploitation attack that uses a compromised host to pass traffic through a firewall that would otherwise be dropped. It is mitigated primarily through the use of proper trust models. Antivirus software and host-based IDS can help detect and prevent an attacker installing port redirecting utilities on the host.

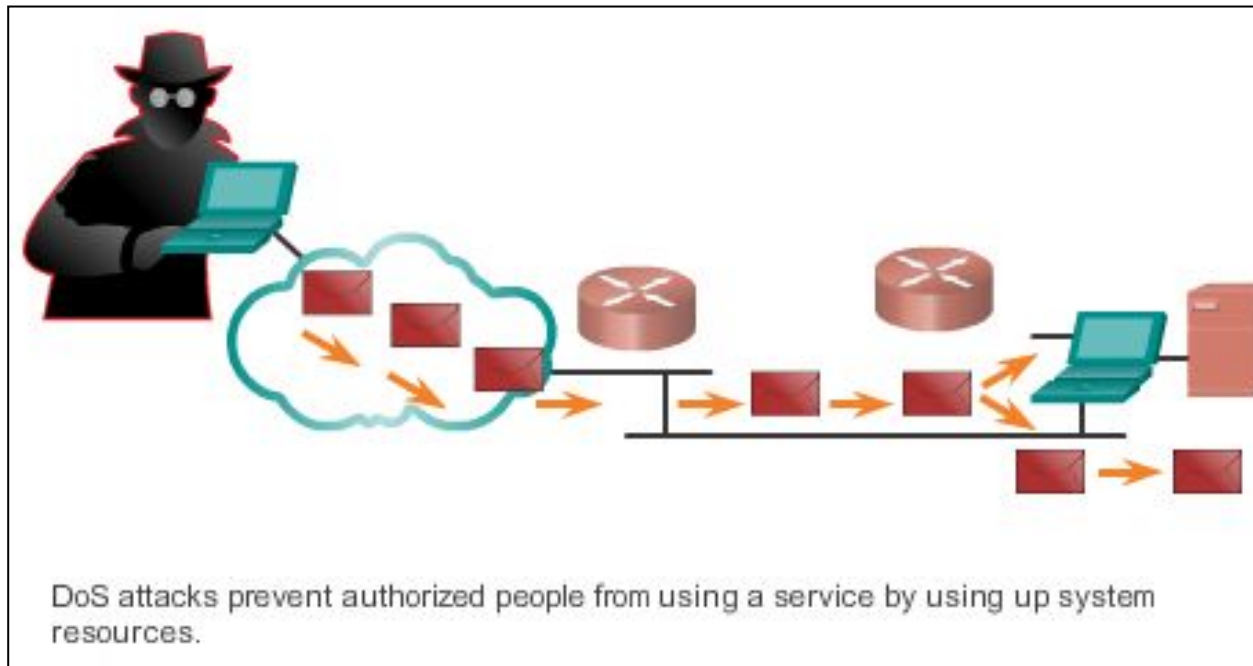




Vulnerabilities and Network Attacks

Denial of Service (DoS) Attacks

DoS Attack	
Resource overloads	Malformed data
Disk space, bandwidth, buffers	Oversized packets such as ping of death
Ping floods such as smurf	Overlapping packet such as winuke
Packet storms such as UDP bombs and fraggle	Unhandled data such as teardrop





Mitigating Network Attacks

Backup, Upgrade, Update, and Patch

Antivirus software can detect most viruses and many Trojan horse applications and prevent them from spreading in the network.

- Keep current with the latest versions of antivirus software.
- Install updated security patches.





Mitigating Network Attacks

Authentication, Authorization, and Accounting

Authentication, Authorization, and Accounting (AAA, or “triple A”)

- **Authentication** – Users and administrators must prove their identity. Authentication can be established using username and password combinations, challenge and response questions, token cards, and other methods.
- **Authorization** – Determines which resources the user can access and the operations that the user is allowed to perform.
- **Accounting** – Records what the user accessed, the amount of time the resource is accessed, and any changes made.



Mitigating Network Attacks

Firewalls

A Firewall resides between two or more networks. It controls traffic and helps prevent unauthorized access. Methods used are:

- Packet Filtering
- Application Filtering
- URL Filtering
- Stateful Packet Inspection (SPI) – Incoming packets must be legitimate responses to requests

Firewalls



Mitigating Network Attacks

Endpoint Security

- Common endpoints are laptops, desktops, servers, smart phones, and tablets.
- Employees must follow the companies documented security policies to secure their devices.
- Policies often include the use of anti-virus software and host intrusion prevention.

Common Endpoint Devices





Securing Devices

Introduction to Securing Devices

- Part of network security is securing devices, including end devices and intermediate devices.
- Default usernames and passwords should be changed immediately.
- Access to system resources should be restricted to only the individuals that are authorized to use those resources.
- Any unnecessary services and applications should be turned off and uninstalled, when possible.
- Update with security patches as they become available.



Securing Devices

Passwords

Weak and Strong Passwords

Weak Password	Why it is weak
secret	Simple dictionary password
smith	Mother's maiden name
toyota	Make of a car
bob1967	Name and birthday of a user
Blueleaf23	Simple words and numbers

Strong Password	Why it is strong
b67n42d39c	Combines alphanumeric characters
12^h u4@1p7	Combines alphanumeric characters, symbols, and also includes a space



Securing Devices

Basic Security Practices

- Encrypt passwords.
- Require minimum length passwords.
- Block brute force attacks.
- Use Banner Message.
- Set EXEC timeout.

Securing Devices

```

Router(config)#service password-encryption
Router(config)#security password min-length 8
Router(config)#login block-for 120 attempts 3 within 60
Router(config)#line vty 0 4
Router(config-vty)#exec-timeout 10
Router(config-vty)#end
Router#show running-config
-
!
line vty 0 4
 password 7 03095A0F034F38435B49150A1819
 exec-timeout 10
 login
  
```




Securing Devices

Enabling SSH

Enabling SSH



```

R1# conf t
R1(config)# ip domain-name span.com
R1(config)# crypto key generate rsa general-keys modulus 1024
The name for the keys will be: R1.span.com
% The key modulus size is 1024 bits
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]
R1(config)#
*Dec 13 16:19:12.079: %SSH-5-ENABLED: SSH 1.99 has been enabled
R1(config)# username Bob secret cisco
R1(config)# line vty 0 4
R1(config-line)# login local
R1(config-line)# transport input ssh
R1(config-line)# exit
  
```

- Step 1: Configure the IP domain name.
- Step 2: Generate one-way secret keys.
- Step 3: Verify or create a local database entry.
- Step 4: Enable VTY inbound SSH sessions.



11.3 Basic Network Performance



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Ping

Interpreting ICMP Messages

- **!** – indicates receipt of an ICMP echo reply message
- **.** – indicates a time expired while waiting for an ICMP echo reply message
- **U** – an ICMP unreachable message was received

Testing Local TCP/IP Stack

Pinging the local host confirms that TCP/IP is installed and working on the local network adapter.

C:\>ping 127.0.0.1

Pinging 127.0.0.1 causes a device to ping itself.

Local Area Connection Properties

General Authentication **Advanced**

Connect using:
 VIA Rhine II Fast Ethernet Adapter Configure...

This connection uses the following items:

- QoS Packet Scheduler
- Network Monitor Driver
- Internet Protocol (TCP/IP)**

Install... Uninstall Properties

Description
 Allows your computer to access resources on a Microsoft network.

Show icon in notification area when connected
 Notify me when this connection has limited or no connectivity

OK Cancel



Ping

Leveraging Extended Ping

The Cisco IOS offers an "extended" mode of the `ping` command:

- R2# **ping**
- Protocol [ip]:
- Target IP address: **192.168.10.1**
- Repeat count [5]:
- Datagram size [100]:
- Timeout in seconds [2]:
- Extended commands [n]: **y**
- Source address or interface: **10.1.1.1**
- Type of service [0]:



Ping Network Baseline

Baseline with ping

```
C:\>ping 10.66.254.159

Pinging 10.66.254.159 with 32 bytes of data:

Reply from 10.66.234.159: bytes=32 time<1ms TTL=128
Reply from 10.66.234.159: bytes=32 time<1ms TTL=128
Reply from 10.66.234.159: bytes=32 time<1ms TTL=128
Reply from 10.66.234.159: bytes=32 time<1ms TTL=128

Ping statistics for 10.66.254.159:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

MAR 17, 2013 14:41:06

```
C:\>ping 10.66.254.159

Pinging 10.66.254.159 with 32 bytes of data:

Reply from 10.66.234.159: bytes=32 time<6ms TTL=128
Reply from 10.66.234.159: bytes=32 time<6ms TTL=128
Reply from 10.66.234.159: bytes=32 time<6ms TTL=128
Reply from 10.66.234.159: bytes=32 time<6ms TTL=128

Ping statistics for 10.66.254.159:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 6ms, Maximum = 6ms, Average = 6ms
```



Ping Network Baseline (Cont.)

Router Ping Capture - Saving to a text file



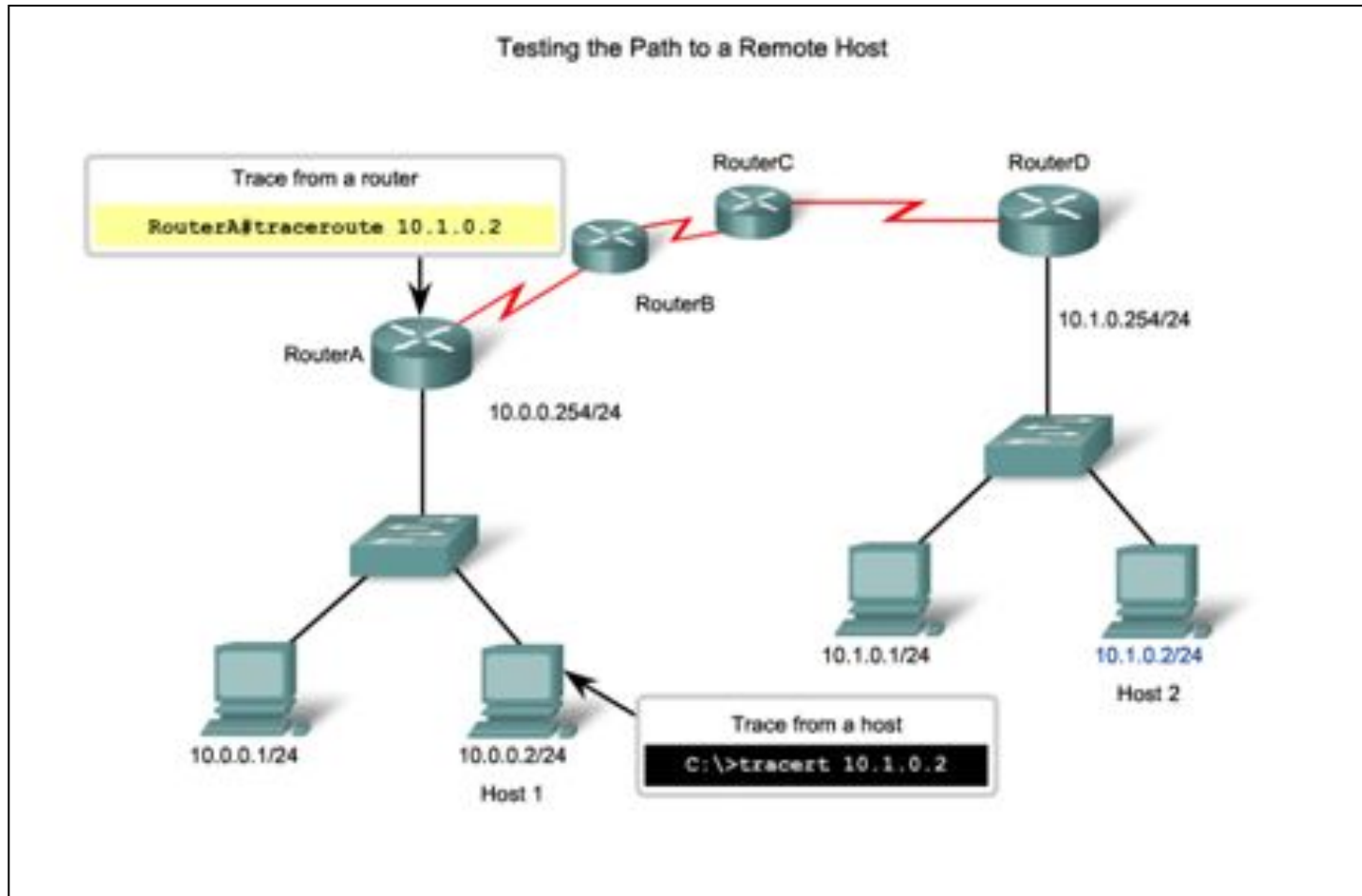
In the terminal session:

1. Start the text capture process.
2. Issue a **ping** <ip address> command.
3. Stop the capture process.
4. Save the text file.



Tracert

Interpreting Tracert Messages





Show Commands

Common Show Commands Revisited

The status of nearly every process or function of the router can be displayed using a **show** command.

Frequently used show commands:

- **show running-config**
- **show interfaces**
- **show arp**
- **show ip route**
- **show protocols**
- **show version**



Show Commands

Viewing Router Settings With Show Version

Cisco IOS Version

System Bootstrap

Cisco IOS Image

CPU and RAM

Number and Type of Physical Interfaces

Amount of NVRAM

Amount of Flash

Configuration Register

```

Router#show version
Cisco Internetwork Operating System Software
IOS(tm)2500 Software (C2500-I-L),Version 12.0(17a),RELEASE
SOFTWARE (fcl)
Copyright (c)1986-2002 by cisco Systems,Inc.
Compiled Mon 11-Feb-02 05:55 by kellythw
image text-base:0x00001000
ROM:system Bootstrap,Version 11.0(10c),SOFTWARE
BOOTFLASH :3000 Bootstrap Software (IGS-BOOT-R),Version
11.0(10c),RELEASE SOFTWARE (fcl)
System image file is "flash:c2500-i-l.120-17a.bin"
cisco 2500 (68030 processor(revision N) With 2048K/2048K
bytes of memory.
processor bord ID 08860060,with hardware revision 00000000
Bridging software.
X.25 software,version 3.0.0.
1 Ethernet/IEEE 802.3 interface(s)
2 Serial network interface(s)
32K bytes of non-volatile Configuration memory.
8192K bytes of processor board system flash (Read ONLY)
Configuration register is 0x2102
Router#
  
```



Show Commands

Viewing Switch Settings with Show Version

show version Command

```

Switch#show version
Cisco IOS Software, C2960 Software (C2960-LANBASE-M), Version 12.2(25)SEE2,
RELEASE SOFTWARE (fc1)
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Fri 28-Jul-06 04:33 by yenanh
Image text-base: 0x00003000, data-base: 0x00AA2F34

ROM: Bootstrap program is C2960 boot loader
BOOTLDR: C2960 Boot Loader (C2960-HBOOT-M) Version 12.2(25r)SEE1, RELEASE
SOFTWARE (fc1)

Switch uptime is 2 minutes
System returned to ROM by power-on
System image file is "flash:c2960-lanbase-mz.122-25.SEE2/c2960-lanbase-
mz.122-25.SEE2.bin"

cisco WS-C2960-24TT-L (PowerPC405) processor (revision B0) with 61440K/4088K
bytes of memory.
Processor board ID FOC1107Z92N
Last reset from power-on
1 Virtual Ethernet interface
  
```



Host and IOS Commands

ipconfig Command Options

- **ipconfig** – Displays ip address, subnet mask, default gateway.
- **ipconfig /all** – Also displays MAC address.
- **ipconfig /displaydns** – Displays all cached dns entries in a Windows system.

```

ipconfig

C:\>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . :
    IP Address. . . . . : 192.168.1.2
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.254
  
```

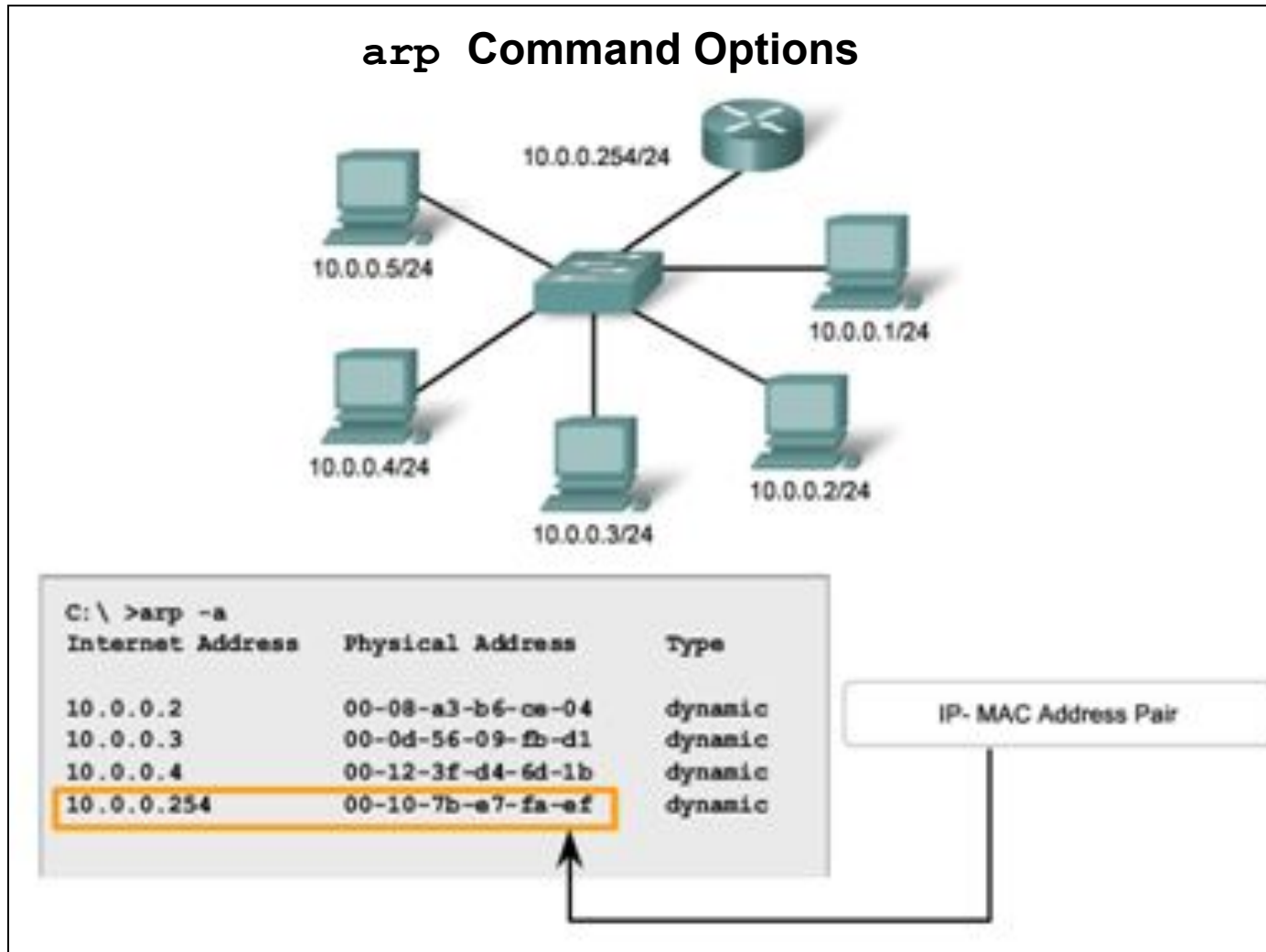
Legend

- IP address for this host computer
- Local network subnet mask
- Default gateway address for this host computer



Host and IOS Commands

arp Command Options





Host and IOS Commands

show cdp neighbors Command Options

show cdp neighbors command provides information about each directly connected CDP neighbor device.

```

R3#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone

Device ID         Local Interface    Holdtime    Capability    Platform    Port ID
S3                Fas 0/0           151         S I          WS-C2950    Fas 0/6
R2                Ser 0/0/1         125         R            1841        Ser 0/0/1

R3#show cdp neighbors detail

Device ID: R2
Entry address(es):
  IP address : 192.168.1.2
Platform: Cisco 1841, Capabilities: Router Switch IGMP
Interface: Serial0/0/1, Port ID (outgoing port): Serial0/0/1
Holdtime : 161 sec

Version :
    
```



Host and IOS Commands

Using the `show ip interface brief` Command

The `show ip interface brief` command verifies the status of all network interfaces on a router or a switch.

```
Router1#show ip interface brief
Interface          IP-Address      OK?  Method  Status        Protocol
FastEthernet0/0    192.168.254.254 YES   NVRAM    up             up
FastEthernet0/1/0  unassigned      YES   unset    down           down
Serial0/0/0        172.16.0.254   YES   NVRAM    up             up
Serial0/0/1        unassigned      YES   unset    administratively down  down
```

```
Router1#ping 192.168.254.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.254.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

```
Router1#traceroute 192.168.0.1
Type escape sequence to abort.
Tracing the route to 192.168.0.1
 0 172.16.0.253 8 msec 4 msec 8 msec
 1 10.0.0.254 16 msec 16 msec 8 msec
 2 192.168.0.1 16 msec * 20 msec
```




11.4 Managing IOS Configuration Files



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Router and Switch File Systems

Router File Systems

show file systems command – Lists all of the available file systems on a Cisco 1941 route.

The asterisk (*) indicates this is the current default file system.

```

Router# show file systems
File Systems:

      Size (b)      Free (b)      Type  Flags  Prefixes
      -          -          -     -     -
      -          -          opaque rw    archive:
      -          -          opaque rw    system:
      -          -          opaque rw    tmsys:
      -          -          opaque rw    null:
      -          -          network rw    tftp:
      * 256487424    183234560    disk  rw    flash0: flash:#
      -          -          disk  rw    flash1:
      262136      254779      nvram  rw    nvram:
      -          -          opaque wo    syslog:
      -          -          opaque rw    xmodem:
      -          -          opaque rw    ymodem:
      -          -          network rw    rcp:
      -          -          network rw    http:
      -          -          network rw    ftp:
      -          -          network rw    scp:
      -          -          opaque ro    tar:
      -          -          network rw    https:
      -          -          opaque ro    cns:
  
```



Router and Switch File Systems

Switch File Systems

The **show file systems** command lists all of the available file systems on a Catalyst 2960 switch.

```
Switch#show file systems
File Systems:

  Size(b)   Free(b)   Type   Flags  Prefixes
*  32514048  20887552  flash  rw     flash:
   -         -         opaque rw     vb:
   -         -         opaque ro     bs:
   -         -         opaque rw     system:
   -         -         opaque rw     tmpsys:
   65536     48897    nvram  rw     nvram:
   -         -         opaque ro     xmodem:
   -         -         opaque ro     ymodem:
   -         -         opaque rw     null:
   -         -         opaque ro     tar:
   -         -         network rw     tftp:
   -         -         network rw     rcp:
   -         -         network rw     http:
   -         -         network rw     ftp:
   -         -         network rw     scp:
   -         -         network rw     https:
   -         -         opaque ro     cns:
```



Backup and Restore Configuration Files

Backup and Restore Using Text Files

Saving to a Text File in TeraTerm

The screenshot shows the TeraTerm Web 3.1 interface. The main window displays a terminal session with the following text:

```

C1841 Software (C1841-IPBASEK9-M), Version 12.4(11)T, RELEASE
http://www.cisco.com/techsupport
Copyright 1986-2006 by Cisco Systems, Inc.
Compiled 15:20 by prod_rel_teas
Version 12.3(8r)T8, RELEASE SOFTWARE (fcl)
...
This product contains cryptographic features and is subject to U.S. and local country laws governing import, export, and use. Delivery of Cisco cryptographic products does not constitute a warranty of any kind, whether expressed or implied; Cisco hereby disclaims any liability that may arise from any defect in or damage to any product arising from its use. Delivery of Cisco cryptographic products does not constitute a warranty of any kind, whether expressed or implied; Cisco hereby disclaims any liability that may arise from any defect in or damage to any product arising from its use. Delivery of Cisco cryptographic products does not constitute a warranty of any kind, whether expressed or implied; Cisco hereby disclaims any liability that may arise from any defect in or damage to any product arising from its use.
A summary of U.S. laws governing Cisco cryptographic products may be found at: http://www.cisco.com/techsupport/1841-1.html
--More--
  
```

Overlaid on the terminal window is a 'Tera Term Log' dialog box. The 'Look in:' field is set to 'My Documents'. The file list shows 'DESKTOP.INC'. The 'File name:' field contains '1841-1.txt'. Below the dialog, a smaller 'Tera Term Log' window displays the following information:

Filename:	test.txt
Bytes transferred:	1699

Buttons for 'Close', 'Pause', and 'Help' are visible at the bottom of the log window.

In the terminal session:

1. Start the log process
2. Issue a **show running-config** command
3. Close the log



Backup and Restore Configuration Files

Backup and Restore Using TFTP

- Configuration files can be stored on a Trivial File Transfer Protocol (TFTP) server.
- **copy running-config tftp** – Saves the running configuration to a TFTP server.
- **copy startup-config tftp** – Saves the startup configuration to a TFTP server.

```
Router#copy running-config tftp
Remote host []? 131.108.2.155
Name of configuration file to write[tokyo-config]?tokyo.2
Write file tokyo.2 to 131.108.2.155? [confirm]
Writing tokyo.2 !!!!!!! [OK]
```



Backup and Restore Configuration Files

Using USB Interfaces on a Cisco Router

- USB flash drive must be formatted in a FAT16 format.
- Can hold multiple copies of the Cisco IOS and multiple router configurations.
- Allows administrator to easily move configurations from router to router.





Backup and Restore Configuration Files

Backup and Restore Using USB

Backup to USB Drive

```
R1#copy running-config usbflash0:/ ()
Destination filename [running-config]? R1-Config
5024 bytes copied in 0.736 secs (6826 bytes/sec)
```

Copying to USB flash drive, and no file pre-exists

```
R1#copy running-config usbflash0:/
Destination filename [running-config]? R1-Config
%Warning:There is a file already existing with this name
Do you want to over write? [confirm]
5024 bytes copied in 1.796 secs (2797 bytes/sec)
```

Copying to USB flash drive, and the same configuration file already exists on the drive.



11.5 Summary



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Chapter 11: Summary

In this chapter, you learned:

- Good network design incorporates reliability, scalability, and availability.
- Networks must be secured from viruses, Trojan horses, worms and network attacks.
- Document Basic Network Performance.
- Test network connectivity using **ping** and **tracert**.
- Use IOS commands to monitor and view information about the network and network devices.
- Back up configuration files using TFTP or USB.

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