evropský sociální fond v ČR
EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
PLZEŇSKÝ KRAJ
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Networking

Bc. Martin Pruša

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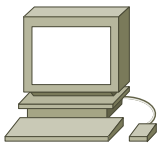
Icons Used in This Book

	Router
	Switch
	NAT
	PC

Content

Lab 1A – Basic Security and Remote Access

Topology

Picture #1

Objectives

- Configure and verify basic security.
- Select the required tools and commands to configure basic security.
- Verify the configuration and operation by using the proper show, ping, telnet, ssh and debug commands.

Required Resources

- 2 routers (Cisco 1941).
- Serial and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The link between routers will use the 192.168.1.0/30 network
- What subnet mask will be used for the subnet? _____
- What is the maximum number of host addresses that could be used on this subnet? _____
- What is the IP address R1? _____
- What is the IP address of R2? _____

Step 2: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

Step 3: Cable a network that is similar to the one in the Topology

Step 4: Perform Basic Router Configuration

- Configure the router hostname

  What command is used to configure this?

  _____

- Disable DNS lookup

  What command is used to configure this?

  _____

- Synchronize unsolicited messages with solicited output and prompts for the console and virtual terminal lines

  What command is used to configure this?

  _____

- configure a message-of-the-day banner

  What command is used to configure this?

  _____

Step 5: R1 - Configure Telnet

- What command is used to configure this?

  _____

  _____

  _____

Step 6: R2 - Configure SSH

- What command is used to configure this?

  _____

  _____

  _____

  _____

  _____

Step 7: Verify connectivity

- What command is used to configure this?

  _____

Step 8: Encrypt all clear text passwords in your running configuration

- What command is used to configure this?

  _____

Step 9: Save running-configuration

- What command is used to configure this?

  _____

Hints

show ssh

show ip ssh

ip domain-lookup

copy r s

write

banner motd #

TEXT TEXT TEXT

#

logging synchronous

ping

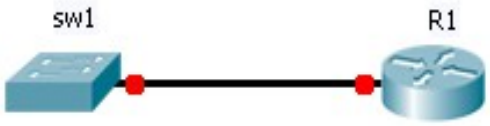
telnet

ssh

Notes

Lab 1B – Basic Security and Remote Access

Topology



Picture #2

Objectives

- Configure and verify basic security.
- Select the required tools and commands to configure basic security.
- Verify the configuration and operation by using the proper show, ping, telnet, ssh and debug commands.

Required Resources

- 1 router (Cisco 1941).
- 1 switch (Cisco 2960)
- UTP and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The link between router and switch will use the 192.168.2.4/30 network
- What subnet mask will be used for the subnet? _____
- What is the maximum number of host addresses that could be used on this subnet? _____
- What is the IP address R1? _____
- What is the IP address of sw1? _____

Step 2: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

Step 3: Cable a network that is similar to the one in the Topology

Step 4: Perform Basic Router/Switch Configuration

- Configure the router/switch hostname

  What command is used to configure this?

  _____

- Disable DNS lookup

  What command is used to configure this?

  _____

- Synchronize unsolicited messages with solicited output and prompts for the console and virtual terminal lines

  What command is used to configure this?

  _____

- configure a message-of-the-day banner

  What command is used to configure this?

  _____

Step 5: sw1 - Configure Telnet

- What command is used to configure this?

  _____

  _____

  _____

Step 6: R1 - Configure SSH

- What command is used to configure this?

  _____

  _____

  _____

  _____

  _____

Step 7: Verify connectivity

- What command is used to configure this?

  _____

Step 8: Encrypt all clear text passwords in your running configuration

- What command is used to configure this?

  _____

Step 9: Save running-configuration

- What command is used to configure this?

  _____

Hints

show ssh

show ip ssh

ip domain-lookup

copy r s

write

banner motd #

TEXT TEXT TEXT

#

logging synchronous

ping

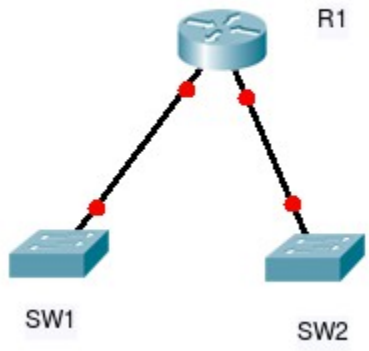
telnet

ssh

Notes

Lab 2A – CIDR, VLSM and broadcast domain

Topology



Picture #3

Objectives

- Calculate subnets
- Configure basic security.
- Verify the configuration and operation by using the proper show, ping, telnet, ssh and debug commands.

Required Resources

- 1 router (Cisco 1941).
- 2 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class C address 192.168.200.0/24
- LAN1 (contains the SW1) will support 20 hosts
- LAN2 (contains the SW2) will support 40 hosts
- LAN3 (contains the loopback 1) will support 10 hosts
- LAN4 (contains the loopback 2) will support 3 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
LAN3				
LAN4				

Chart #1

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Verify configuration

Step 8: Save running-configuration to the tftp server

- What command is used to configure this?

_____

Hints

Usable IP's – 2^n-2 (n – number of ones in the mask)

interface loopback 1

description LAN1

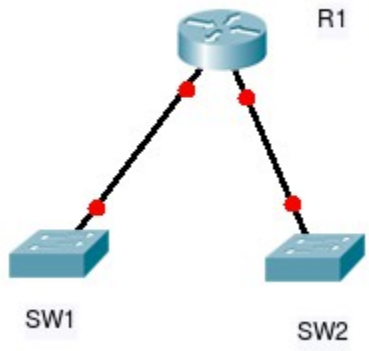
wr

copy r s

Notes

Lab 2B – CIDR, VLSM and broadcast domain

Topology



Picture #4

Objectives

- Calculate subnets.
- Configure basic security.
- Verify the configuration and operation by using the proper show, ping, telnet, ssh and debug commands.

Required Resources

- 1 router (Cisco 1941).
- 2 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 (contains the SW1) will support 200 hosts
- LAN2 (contains the SW2) will support 100 hosts
- LAN3 (contains the loopback 1) will support 4 hosts
- LAN4 (contains the loopback 2) will support 60 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
LAN3				
LAN4				

Chart #2

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Verify configuration

Step 8: Save running-configuration to the tftp server

- What command is used to configure this?

_____

Hints

Usable IP's – 2^n-2 (n – number of ones in the mask)

interface loopback 1

description LAN1

wr

copy r s

line vty 0 4

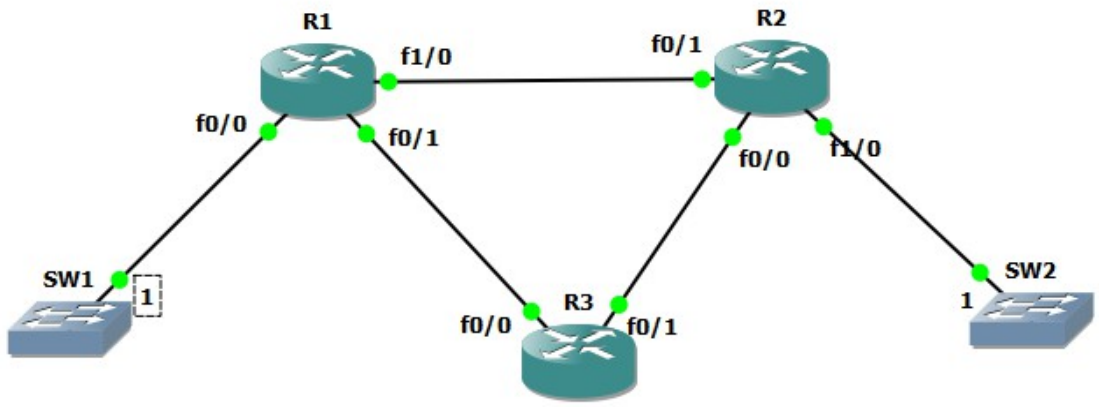
password *cisco*

login

Notes

Lab 3A - Static Routing

Topology



Picture #5

Objectives

- Calculate subnets.
- Configure basic security.
- Configure static routing.
- Verify the configuration and operation by using the proper show, ping, telnet, ssh and debug commands.

Required Resources

- 3 routers (Cisco 1941).
- 2 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 (contains the SW1) will support 200 hosts
- LAN2 (contains the SW2) will support 100 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	**network**	**mask**	**max. hosts**
LAN1				
LAN2				
R1-R2				
R1-R3				
R2-R3				

Chart #3

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Perform Static Routing Configuration

- What command is used to configure this?

  _____

  _____

Step 8: Verify configuration

- What command is used to configure this?

  _____

Step 9: Save running-configuration to the memory

- What command is used to configure this?

  _____

Hints

ip route *network mask forwarding_IP*

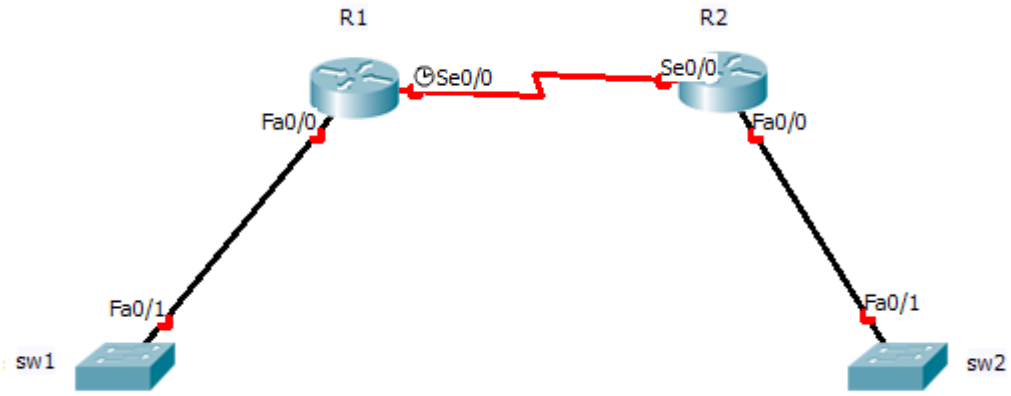
ip route *network mask interface*

copy r s

Notes

Lab 3B - Static Routing

Topology



Picture #6

Objectives

- Calculate subnets.
- Configure basic security.
- Configure static routing.
- Verify the configuration and operation by using the proper show, ping, telnet, ssh and debug commands.

Required Resources

- 2 routers (Cisco 1941).
- 2 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/15
- LAN1 (contains the SW1) will support 20 hosts
- LAN2 (contains the SW2) will support 10 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R2				

Chart #4

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Perform Static Routing Configuration

- What command is used to configure this?

_____
_____

Step 8: Verify configuration

- What command is used to configure this?

_____

Step 9: Save running-configuration to the memory

- What command is used to configure this?

_____

Hints

ip route *network mask forwarding_IP*

ip route *network mask interface*

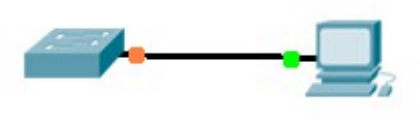
copy r s
wr

line con 0
password *cisco*
login
logging synchronous

Notes

Lab 4A - Wireshark

Topology



Picture #7

Objectives

- Calculate subnets.
- Configure basic security.
- Run wireshark and capture telnet/ssh communication.

Required Resources

- 1 PC
- 1 switch (Cisco 2960)
- Ethernet and console cable.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/26

Step 2: Fill the table

	interface	**network**	**mask**	**max. hosts**
LAN				

Chart #5

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Switch Configuration

Step 7: Run wireshark

Step 8: Capture the communication

Step 9: Login to the switch with telnet and ssh

Step 10: Examine communication

Hints

line vty 0 4

password *heslo*

login

Notes

Lab 4B - Wireshark

Topology

Picture #8

Objectives

- Calculate subnets.
- Configure basic security.
- Run wireshark and capture telnet/ssh communication.

Required Resources

- 1 PC
- 1 router (Cisco 1941)
- Ethernet and console cable.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 192.168.100.128/25

Step 2: Fill the table

	interface	**network**	**mask**	**max. hosts**
LAN				

Chart #6

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Run wireshark

Step 8: Capture the communication

Step 9: Login to the switch with telnet and ssh

Step 10: Examine communication

Hints

line vty 0 4

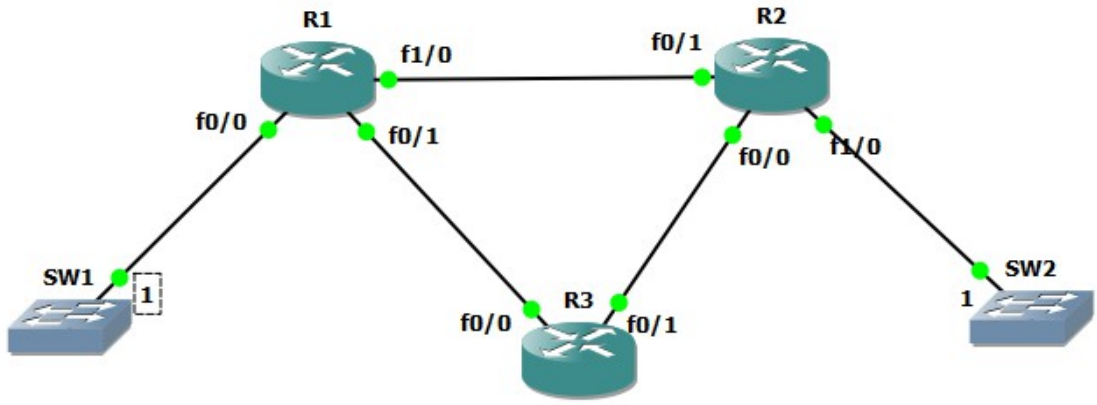
password *heslo*

login

Notes

Lab – 5A RIP

Topology



Picture #9

Objectives

- Calculate subnets.
- Configure basic security.
- Configure RIP.

Required Resources

- 2 switches (Cisco 2960)
- 3 routers (Cisco 1941)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 192.168.100.0/24
- LAN1 (contains the SW1) will support 20 hosts
- LAN2 (contains the SW2) will support 5 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R3				
R1-R2				
R2-R3				

Chart #7

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Configure RIP

- What command is used to configure this?

_____

_____

_____

_____

Hints

router rip

network *net*

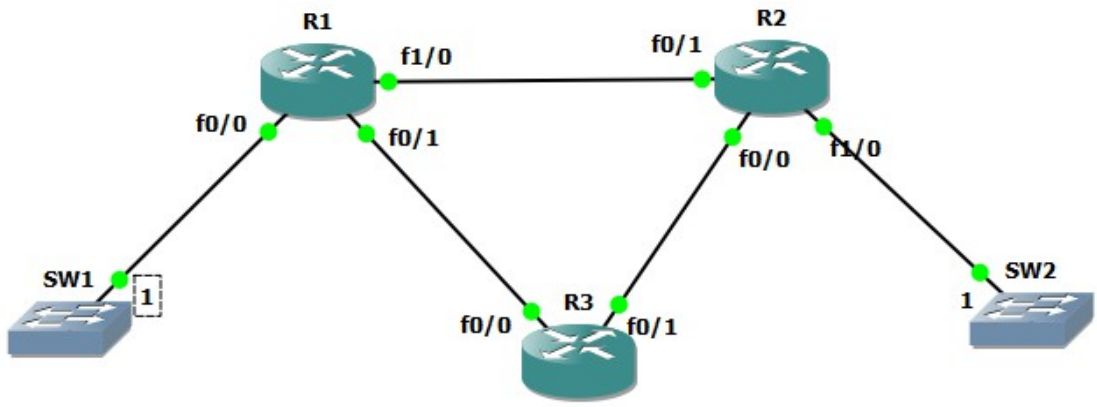
version 2

no auto-summary

Notes

Lab – 5B RIP

Topology



Picture #10

Objectives

- Calculate subnets.
- Configure basic security.
- Configure RIP.

Required Resources

- 2 switches (Cisco 2960)
- 3 routers (Cisco 1941)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 172.17.0.0/16
- LAN1 (contains the SW1) will support 100 hosts
- LAN2 (contains the SW2) will support 200 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R3				
R1-R2				
R2-R3				

Chart #8

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Configure RIP

- What command is used to configure this?

_____

_____

_____

_____

Hints

router rip

network *net*

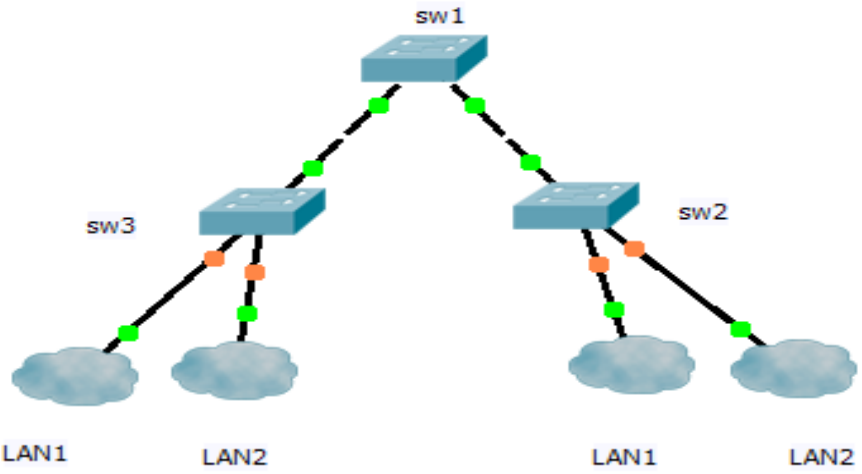
version 2

no auto-summary

Notes

Lab 6A - VLAN

Topology



Picture #11

Objectives

- Calculate subnets.
- Configure basic security.
- Configure Trunk and VLAN.

Required Resources

- 3 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 172.18.0.0/16
- LAN1 will support 10 hosts
- LAN2 will support 20 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				

Chart #9

Step 3: Configure Trunk and VLAN

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Switch Configuration

Hints

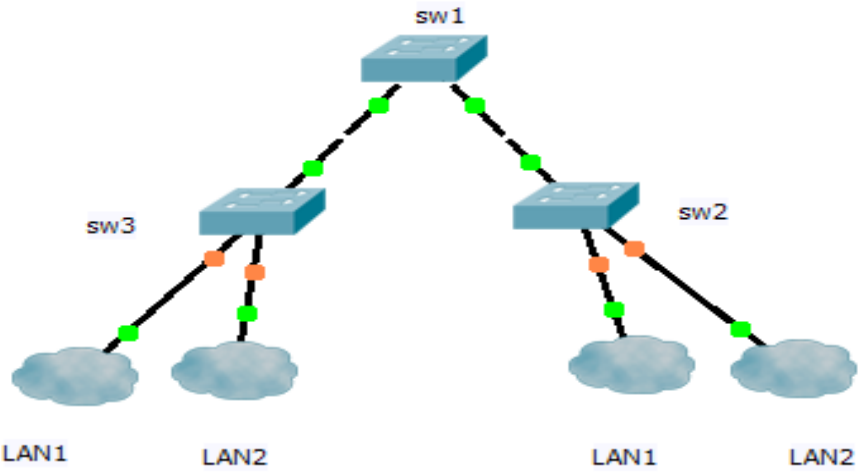
Switchport mode access
switchport access vlan 10

switchport mode trunk
switchport trunk allow vlan 1,10

Notes

Lab 6B - VLAN

Topology



Picture #12

Objectives

- Calculate subnets.
- Configure basic security.
- Configure Trunk and VLAN.

Required Resources

- 3 switches (Cisco 2960)
- Ethernet and console cables.

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 172.18.0.0/18
- LAN1 will support 10 hosts
- LAN2 will support 20 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				

Chart #10

Step 3: Configure Trunk and VLAN

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Switch Configuration

Hints

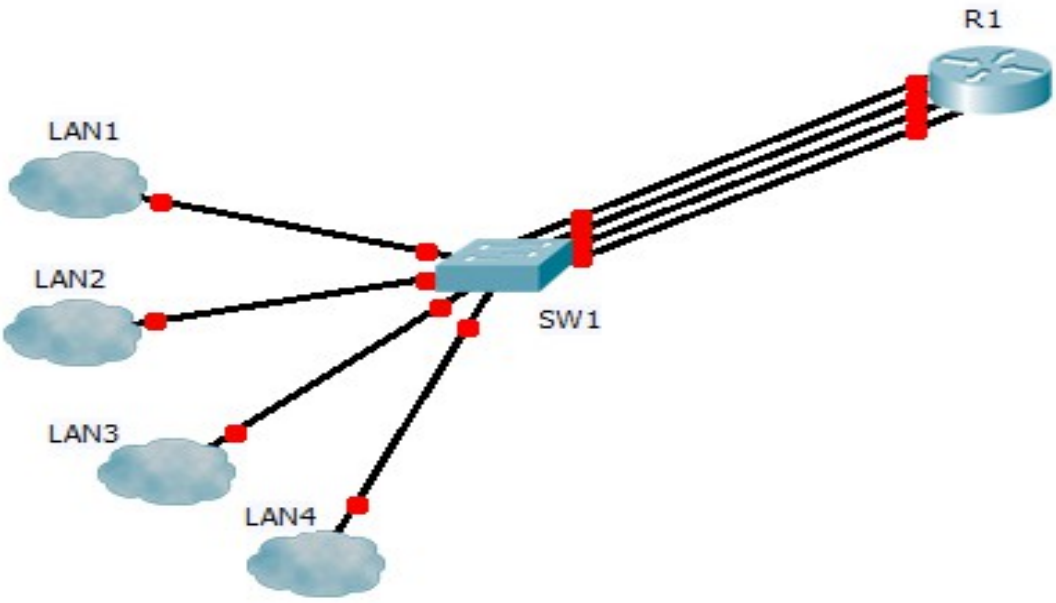
Switchport mode access
switchport access vlan 10

switchport mode trunk
switchport trunk allow vlan 1,10

Notes

Lab 7A – InterVLAN routing

Topology



Picture #13

Objectives

- Calculate subnets.
- Configure basic security.
- Configure VLAN.

Required Resources

- 1 switch (Cisco 2960)
- 1 router (Cisco 1941)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

The assignment is the Class A address 10.0.0.0/8

- LAN1 will support 200 hosts
- LAN2 will support 300 hosts
- LAN3 will support 400 hosts
- LAN4 will support 20 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
LAN3				
LAN4				

Chart #11

Step 3: Configure Vlan

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Configure Router

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 5: Configure Basic Security

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 6: Cable a network that is similar to the one in the Tolopogy

Step 7: Verify routing table

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

Switchport mode access
switchport access vlan 10

sh ip route

line vty 0 4
password *cisco*
login

line con 0
password cisco
login

service password-encryption

sh vlan brief

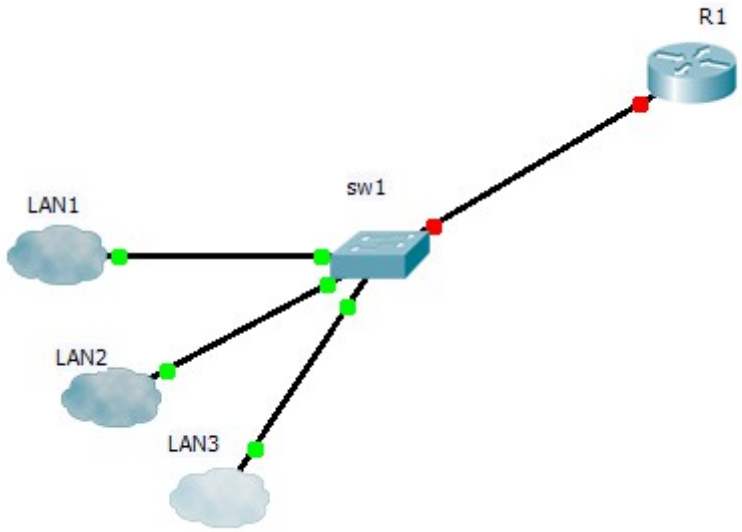
sh run

copy r s
do copy r s
write
do write

Notes

Lab 7B – InterVLAN routing

Topology



Picture #14

Objectives

- Calculate subnets.
- Configure basic security.
- Configure VLAN and trunk.

Required Resources

- 1 switch (Cisco 2960)
- 1 router (Cisco 1941)
- Ethernet and console cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

The assignment is the Class A address 10.0.0.0/8

- LAN1 will support 200 hosts
- LAN2 will support 300 hosts
- LAN3 will support 400 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
LAN3				

Chart #12

Step 3: Configure Vlan

- What command is used to configure this?

Step4: Configure Trunk

- What command is used to configure this?

Step5: Configure Basic Security

- What command is used to configure this?

Step5: Cable a network that is similar to the one in the Tolopogy

Step6: Verify routing trunk and vlans

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

switchport mode access
switchport access vlan 10

switchport mode trunk
switchport trunk allowed vlan add 10

interface gigabitethernet 0/1.1
description POKUS
encapsulation dot1q 1 native
ip add IP MASK
interface gigabitethernet 0/1.10
description DRUHY_POKUS
encapsulation dot1q 10
ip add IP MASK

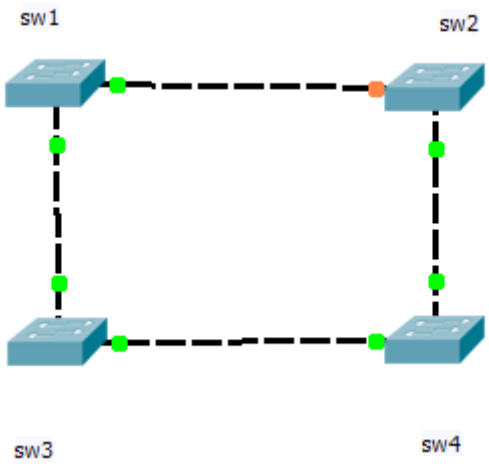
sh vlan brief

copy r s
do copy r s
write
do write

Notes

Lab 8A – VTP

Topology



Picture #15

Objectives

- Calculate subnets
- Configure basic security
- Configure VTP and VLAN

Required Resources

- 4 switches (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

The assignment is the Class C address 192.168.0.0/16

- LAN1 will support 200 hosts – VLAN ID 1
- LAN2 will support 300 hosts – VLAN ID 2
- sw1 – vtp server

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				

Chart #13

Step 3: Cable a network that is similar to the one in the Tolopogy

Step 4: Configure basic security

Step 5: Configure VTP

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 6: Configure VLAN and TRUNK

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 7: Verify VLAN and VTP

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

vtp mode server
vtp domain *POKUS*
vtp password *HESLO*

vtp mode client

vtp mode transparent

line con 0
logging synchronous

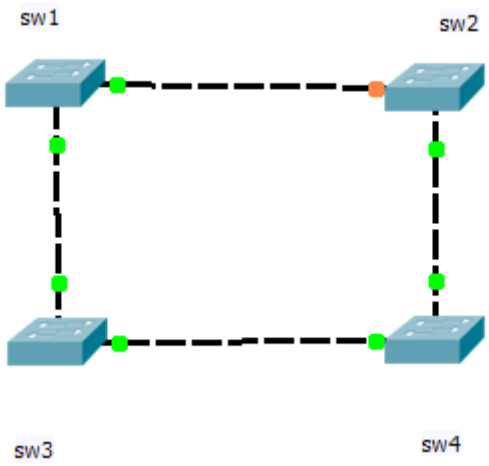
int fa 0/1
switchport mode trunk
switchport trunk allowed vlan add 1,2

int fa0/2
switchport mode access
switchport access vlan 2

Notes

Lab 8B – VTP

Topology



Picture #16

Objectives

- Calculate subnets
- Configure basic security
- Configure VTP and VLAN

Required Resources

- 4 switches (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

The assignment is the Class C address 192.168.0.0/16

- LAN1 will support 10 hosts – VLAN ID 10 / Staff
- LAN2 will support 20 hosts – VLAN ID 20 / Guest
- sw1 – vtp server / domain: cisco

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				

Chart #14

Step 3: Cable a network that is similar to the one in the Tolopogy

Step 4: Configure basic security

Step 5: Configure VTP

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 6: Configure VLAN and TRUNK

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 7: Verify VLAN and VTP

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

vtp mode server
vtp domain *POKUS*
vtp password *HESLO*

vtp mode client

vtp mode transparent

line con 0
logging synchronous

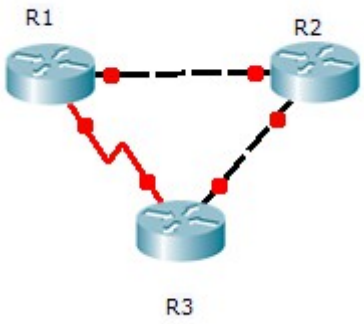
int fa 0/1
switchport mode trunk
switchport trunk allowed vlan add 1,2

int fa0/2
switchport mode access
switchport access vlan 2

Notes

Lab 9A – OSPF

Topology



Picture #17

Objectives

- Calculate subnets
- Configure basic security
- Configure loopbacks
- Configure OSPF

Required Resources

- 3 routers (Cisco 1941)
- Ethernet and conssole cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 (loopback 100 on R1) will support 200 hosts
- LAN2 (loopback 200 on R2) will support 100 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R2				
R1-R3				
R2-R3				

Chart #15

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Configure OSPF

- What command is used to configure this?

_____

_____

Step 8: Verify configuration

- What command is used to configure this?

_____

Step 9: Save running-configuration to the memory

- What command is used to configure this?

  _____

Hints

en
conf t
hostname R1

line vty 0 4
password *CISCO*
login

router ospf 1
network *IP WILD* area 0
network *IP WILD* area 100

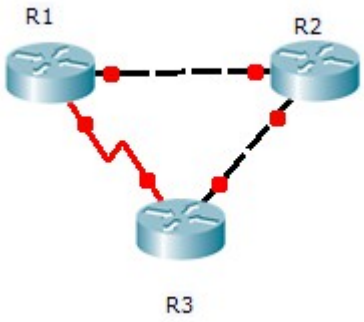
line con 0
password *CISCO*
login
logging synchronous

enable password *CISCO*

Notes

Lab 9B – OSPF

Topology



Picture #18

Objectives

- Calculate subnets
- Configure basic security
- Configure loopbacks
- Configure OSPF

Required Resources

- 3 routers (Cisco 1941)
- Ethernet and conssole cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class B address 172.16.0.0/12
- LAN1 (loopback 100 on R1) will support 100 hosts
- LAN2 (loopback 200 on R2) will support 10 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R2				
R1-R3				
R2-R3				

Chart #16

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Configure OSPF

- What command is used to configure this?

_____

_____

Step 8: Verify configuration

- What command is used to configure this?

_____

Step 9: Save running-configuration to the memory

- What command is used to configure this?

_____

Hints

en
conf t
hostname R1

line vty 0 4
password *CISCO*
login

router ospf 1
network *IP WILD* area 0
network *IP WILD* area 100

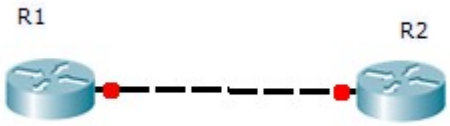
line con 0
password *CISCO*
login
logging synchronous

enable password *CISCO*

Notes

Lab 10A – IPv6

Topology



Picture #19

Objectives

- Configure basic security
- Configure Ipv6
- Configure static routing

Required Resources

- 2 routers (Cisco 1941)
- Ethernet and console cables

Task

Step 1: How long is Ipv6 address?

_____

_____

Step 2: Configure basic security

Step 3: Assign appropriate addresses to the device interfaces

R1-R2 - 2001:db8:1122:12::/64

LAN1 – R1-Loopback - 2001:db8:1234:1::1/64

LAN2 – R2-Loopback - 2001:db8:2233:23::1/64

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step : Create static routing and default route

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

ipv6 route ::/0 2001:DB8:1:1::1

ipv6 unicast-routing

int fa0/0
ipv6 enable
ipv6 address autoconfig

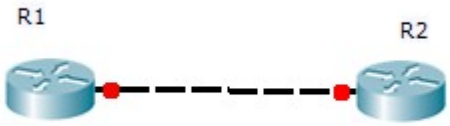
show ipv6 neighbors

ipv6 address *ADDRESS/MASK eui-64*

Notes

Lab 10B – IPv6

Topology



Picture #20

Objectives

- Configure basic security
- Configure Ipv6
- Configure static routing

Required Resources

- 2 routers (Cisco 1941)
- Ethernet and console cables

Task

Step 1: How long is Ipv6 address and IPv4?

_____

_____

Step 2: Configure basic security

Step 3: Assign appropriate addresses to the device interfaces

R1-R2 - 2001:db8:3344:34::/64

LAN1 – R1-Loopback - 2001:db8:1234:1::1/64

LAN2 – R2-Loopback - 2001:db8:2233:23::1/64

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step : Create static routing and default route

- What command is used to configure this?

  _____
  _____
  _____
  _____
  _____
  _____

Hints

ipv6 route ::/0 2001:DB8:1:1::1

ipv6 unicast-routing

int fa0/0
ipv6 enable
ipv6 address autoconfig

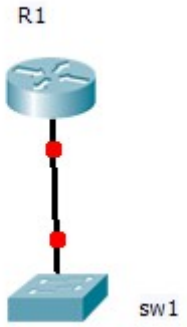
show ipv6 neighbors

ipv6 address *ADDRESS/MASK eui-64*

Notes

Lab 11A – ACL

Topology



Picture #21

Objectives

- Configure basic security
- Configure ACL – block some communication

Required Resources

- 1 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 – VLAN ID 1 will support 10 hosts
- LAN2 – VLAN ID 2 will support 500 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				

Chart #17

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 8: Configure ACL

Block all communication from VLAN 1 to VLAN 2

- What command is used to configure this?

Step 9: Verify configuration

- What command is used to configure this?

Hints

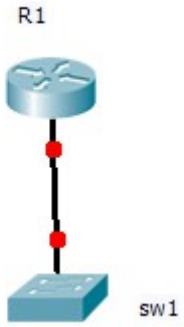
access-list *101* permit tcp *any any* eq telnet

access-list 102 block tcp host *IP* any eq telnet

Notes

Lab 11B – ACL

Topology



Picture #22

Objectives

- Configure basic security
- Configure ACL – block some communication

Required Resources

- 1 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 – VLAN ID 1 will support 10 hosts
- LAN2 – VLAN ID 2 will support 5 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				

Chart #18

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 8: Configure ACL

Block telnet from VLAN 1 to VLAN 2

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 9: Verify configuration

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Hints

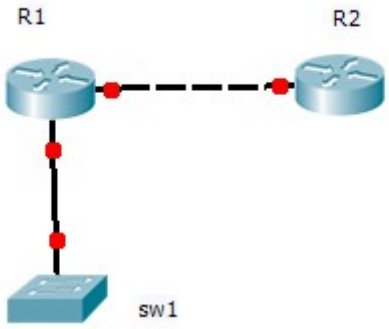
access-list *101* permit tcp *any any* eq telnet

access-list 102 block tcp host *IP* any eq telnet

Notes

Lab 12A – NAT

Topology



Picture #23

Objectives

- Configure basic security
- Configure NAT

Required Resources

- 2 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class B address 172.16.0.0/12
- LAN1 – VLAN ID 1 will support 10 hosts
- LAN2 – VLAN ID 2 will support 5 hosts
- Public IP - R1 – 1.1.1.1/30

Step 2: Fill the table

	interface	**network**	**mask**	**max. hosts**
LAN1				
LAN2				
R1-R2				

Chart #19

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 8: Configure NAT

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 9: Verify configuration

- What command is used to configure this?

  _____
  _____
  _____
  _____
  _____
  _____

Hints

int fa0/0
ip nat inside

int fa0/1
ip nat outside

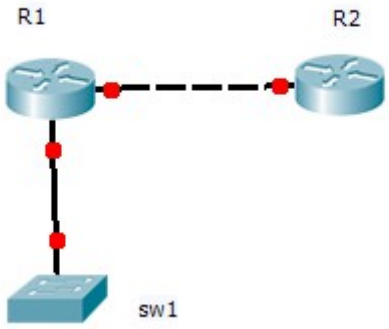
access-list *101* permit ip *INSIDE_NETWORK WILDCARD* any

ip nat pool *PAT OUTSIDE_IP OUTSIDE_IP* netmask *MASK*
ip nat inside source list *101* pool *PAT* overload

Notes

Lab 12B – NAT

Topology



Picture #24

Objectives

- Configure basic security
- Configure NAT

Required Resources

- 2 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class B address 172.16.0.0/12
- LAN1 – VLAN ID 1 will support 1000 hosts
- LAN2 – VLAN ID 2 will support 5 hosts
- Public IP - R1 – 1.1.1.1/30

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R2				

Chart #20

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 8: Configure NAT

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 9: Verify configuration

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

int fa0/0
ip nat inside

int fa0/1
ip nat outside

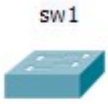
access-list *101* permit ip *INSIDE_NETWORK WILDCARD* any

ip nat pool *PAT OUTSIDE_IP OUTSIDE_IP* netmask *MASK*
ip nat inside source list *101* pool *PAT* overload

Notes

Lab 13A - Recovery

Topology



Picture #25

Objectives

- Password recovery

Required Resources

- 1 switch (Cisco 2960)
- Console cable

Task

Step 1: Send break-key

Step 2: Rename or delete config

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 3: Reboot

- What command is used to configure this?

_____
_____
_____
_____
_____

_____

Step 4: Create or rename config

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 5: Write the running config to the configuration file

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

Hold down the mode button

Notes

Lab 13B - Recovery

Topology

Picture #26

Objectives

- Password recovery

Required Resources

- 1 router (Cisco 1941)
- console cable

Task

Step 1: Send break-key

Step 2: Change configuration register

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 3: Reboot

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Configure and change password

Note: Do not enter copy r s (these command erase your startup configuration)

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 5: Write the running config to the configuration file

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 6: Change configuration register

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 7: Write the running config to the configuration file

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

Confreg 0x2141

config-register 0x2102

copy r s
write
write memory

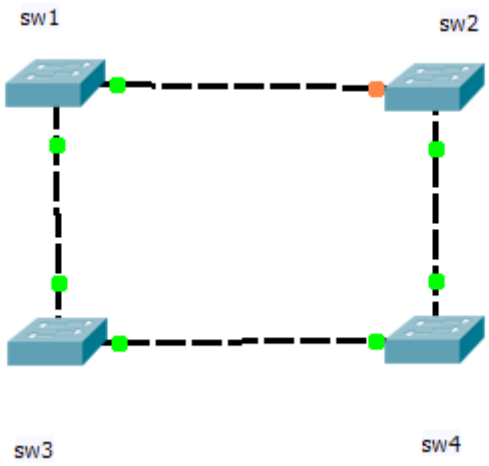
reset

copy s r

Notes

Lab 14A – STP

Topology



Picture #27

Objectives

- Configure basic security
- Configure STP

Required Resources

- 4 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Configure basic security

Step 2: Configure STP

- What command is used to configure this?

_____

_____

_____

_____

_____

Step 3: Change Root switch

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Verify

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

spanning-tree portfast

spanning-tree vlan ID root primary

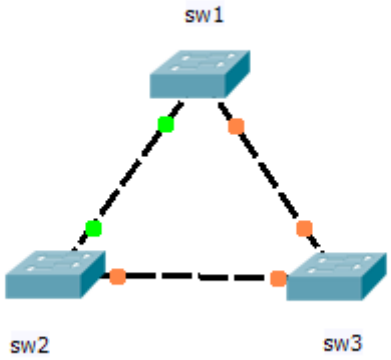
spanning-tree vlan ID root secondary

show spanning-tree bridge

Notes

Lab 14B – STP

Topology



Picture #28

Objectives

- Configure basic security
- Configure STP

Required Resources

- 3 switches (Cisco 2960)
- Ethernet and console cables.

Task

Step 1: Configure basic security

Step 2: Configure STP

- What command is used to configure this?

_____

_____

_____

_____

_____

Step 3: Change Root switch

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Verify

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Hints

spanning-tree portfast

spanning-tree vlan ID root primary

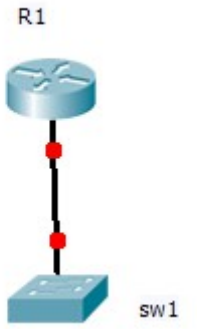
spanning-tree vlan ID root secondary

show spanning-tree bridge

Notes

Lab 15A – DHCP

Topology



Picture #29

Objectives

- Configure basic security
- Configure DHCP

Required Resources

- 1 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class B address 172.16.0.0/12
- LAN1 – VLAN ID 1 will support 10 hosts
- LAN2 – VLAN ID 2 will support 5 hosts

Step 2: Fill the table

	interface	**network**	**mask**	**max. hosts**
LAN1				
LAN2				

Chart #21

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 8: Configure DHCP for all LAN

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 9: Verify configuration

- What command is used to configure this?

  _____
  _____
  _____
  _____
  _____
  _____

Hints

Ip dhcp pool *EXAMPLE*

network IP

default-router *IP*

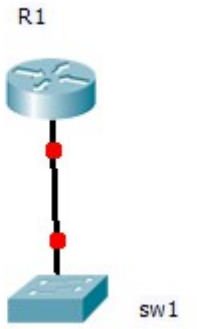
ip dhcp excluded-address *IP*

sh ip dhcp ?

Notes

Lab 15B – DHCP

Topology



Picture #30

Objectives

- Configure basic security
- Configure DHCP

Required Resources

- 1 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class B address 172.16.0.0/12
- LAN1 – VLAN ID 1 will support 150 hosts
- LAN2 – VLAN ID 2 will support 3 hosts

Step 2: Fill the table

	interface	**network**	**mask**	**max. hosts**
LAN1				
LAN2				

Chart #22

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 8: Configure DHCP for all LAN

- What command is used to configure this?

_____
_____
_____
_____
_____
_____

Step 9: Verify configuration

- What command is used to configure this?

  _____
  _____
  _____
  _____
  _____
  _____

Hints

Ip dhcp pool *EXAMPLE*

network IP

default-router *IP*

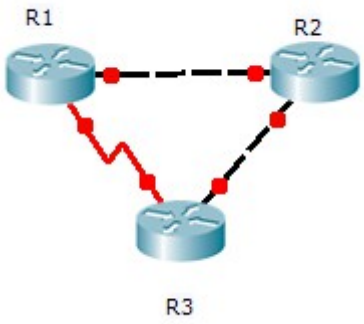
ip dhcp excluded-address *IP*

sh ip dhcp ?

Notes

Lab 16A – EIGRP

Topology



Picture #31

Objectives

- Calculate subnets
- Configure basic security
- Configure loopbacks
- Configure EIGRP

Required Resources

- 3 routers (Cisco 1941)
- Ethernet and conssole cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 (loopback 100 on R1) will support 200 hosts
- LAN2 (loopback 200 on R2) will support 100 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R2				
R1-R3				
R2-R3				

Chart #23

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Configure EIGRP

- What command is used to configure this?

_____

_____

Step 8: Verify configuration

- What command is used to configure this?

_____

Step 9: Save running-configuration to the memory

- What command is used to configure this?

  _____

Hints

en
conf t
hostname R1

line vty 0 4
password *CISCO*
login

router eigrp 100
network *IP WILD*
network *IP WILD*

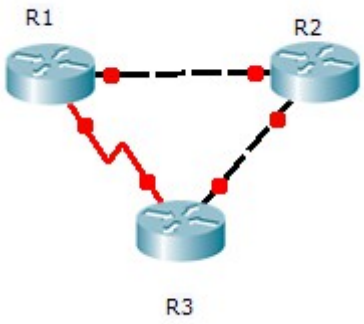
line con 0
password *CISCO*
login
logging synchronous

enable password *CISCO*

Notes

Lab 16B – EIGRP

Topology



Picture #32

Objectives

- Calculate subnets
- Configure basic security
- Configure loopbacks
- Configure EIGRP

Required Resources

- 3 routers (Cisco 1941)
- Ethernet and conssole cables.

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class A address 10.0.0.0/8
- LAN1 (loopback 100 on R1) will support 100 hosts
- LAN2 (loopback 200 on R2) will support 32 hosts
- All Networks between routers will supports 2 hosts

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1				
LAN2				
R1-R2				
R1-R3				
R2-R3				

Chart #24

Step 3: Assign appropriate addresses to the device interfaces

- What command is used to configure this?

_____

_____

_____

_____

_____

_____

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

_____

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration

Step 7: Configure EIGRP

- What command is used to configure this?

_____

_____

Step 8: Verify configuration

- What command is used to configure this?

_____

Step 9: Save running-configuration to the memory

- What command is used to configure this?

  _____

Hints

en
conf t
hostname R1

line vty 0 4
password *CISCO*
login

router eigrp 100
network *IP WILD*
network *IP WILD*

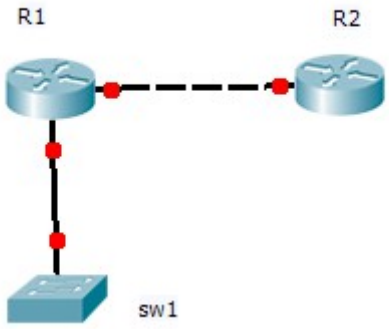
line con 0
password *CISCO*
login
logging synchronous

enable password *CISCO*

Notes

Lab 17 – Example

Topology



Picture #33

Objectives

- Configure basic security
- Configure NAT
- Configure DHCP
- Configure VLAN and TRUNK

Required Resources

- 2 router (Cisco 1941)
- 1 switch (Cisco 2960)
- Ethernet and console cables

Task

Step 1: Examine the network requirements

The addressing for the network as the following requirements:

- The assignment is the Class C address 192.168.0.0/16
- LAN1 – VLAN ID 1 will support 250 hosts
- LAN2 – VLAN ID 2 will support 250 hosts
- Public IP - R1 – 1.1.1.1/30

Step 2: Fill the table

	interface	network	mask	max. hosts
LAN1	Gig0/0.1	192.168.0.0	/24	254
LAN2	Gig0/0.2	192.168.1.0	/24	254
R1-R2	-------	1.1.1.0	/30	2

Chart #25

Step 3: Assign appropriate addresses to the device interfaces (router on stick)

- What command is used to configure this?

R1:

en

conf t

int gig0/0.1

encapsulation dot1Q 1 native

ip add 192.168.0.1 255.255.255.0

exit

int gig0/0.2

encapsulation dot1Q 1 native

ip add 192.168.0.1 255.255.255.0

exit

int gig0/0

no shut

int gig0/0

ip add 1.1.1.1 255.255.255.252

no shut

R2:

en

conf t

int gig0/0

ip add 1.1.1.2 255.255.255.252

no shut

Step 4: Use descriptions to the interfaces

- What command is used to configure this?

```
en
conf t
int gig0/0
description POPIS
```

Step 5: Cable a network that is similar to the one in the Topology

Step 6: Perform Basic Router Configuration and security

```
en
conf t
hostname R1
enable password cisco
service password-encryption
line con 0
password cisco
login
logging synchronous
exit
line vty 0 4
password cisco
login
exit

en
conf t
hostname R2
enable password cisco
service password-encryption
line con 0
password cisco
login
logging synchronous
exit
line vty 0 4
```

password cisco
login
exit

en
conf t
hostname sw1
enable password cisco
service password-encryption
line con 0
password cisco
login
logging synchronous
exit
line vty 0 4
password cisco
login
exit

for all devices do wr or wr or copy r s or do copy r s

Step 7: Configure VLAN and TRUNK

- What command is used to configure this?

en
conf t
int fa0/1
switchport mode trunk
switchport trunk allowed vlan add 1,2
exit
int range fa 0/2 – 10
switchport mode access
switchport access vlan 1
spanning-tree portfast
int range fa 0/11 – 20
switchport mode access

switchport access vlan 2
spanning-tree portfast

Step 8: Configure NAT

- What command is used to configure this?

en
conf t
int gig0/0.1
in nat inside
exit
int gig0/0.2
ip nat inside
exit
int gig0/1
ip nat outside
exit
access-list 101 permit ip any any
ip nat pool PAT 1.1.1.1 1.1.1.1 netmask 255.255.255.252
ip nat inside source list 101 pool PAT overload
ip route 0.0.0.0 0.0.0.0 1.1.1.2

must exists route on R2

Step 9: Configure DHCP

- What command is used to configure this?

en
conf t
ip dhcp pool LAN1
network 192.168.0.0 255.255.255.0
default-router 192.168.0.1
exit
ip dhcp pool LAN2
network 192.168.1.0 255.255.255.0
default-router 192.168.1.1
exit

Step 10: Verify configuration

- What command is used to configure this?

sh run

sh ip dhcp binding

sh ip nat translations

ping *IP*

traceroute *IP*

Notes

Ecology

There are about one billion PC's in use worldwide. There are an additional several hundred million sitting in basements and attics awaiting disposal. Given average lifespans of only two to five years, a tidal wave of computers requiring disposal sweeps towards us. In the United States, the vast majority will not properly disposed of.

What toxins do consumer PC's contain? Where do they end up? And what can you do about it?

A Toxic Brew

Let's start with the toxins computers contain. It's not a pretty picture:

Toxin:	Use and Effects:
Lead	CRT display monitors contain anywhere from two to eight pounds of lead, which can cause brain damage in children and other neurological effects if ingested. CRT's are being disposed of in massive numbers, due to the switch to flat-panel technology. (We're seeing the same phenomenon in TV disposal as the public switches from analog to digital TV). Circuit board soldering also contains lead.
Mercury and Arsenic	Flat panel and laptop displays contain mercury and arsenic, poisonous even in small amounts. Mercury is also present in circuit boards.
Cadmium	Every desktop contains a battery, and laptops contain two or three. Cadmium is among the toxicants in batteries. It's also found in SMD chip resistors, semiconductors, infrared dectectors, and some plastics. Cadmium is a known carcinogen that concentrates within the human body.
Phosphorus	The insides of CRT display monitors are coated with phosphorus dust. You don't want to inhale it.
BFR's	Brominated flame retardants or BFR's coat computer plastics. BFR's have hormonal effects and leading manufacturers like Apple have stopped using them.
Beryllium	Beryllium is another known carcinogen, used in circuit boards and connectors.
Polyvinyl Chloride and Plastics	PVC and plastics compose roughly 20% of computers. Burning them releases dioxins and furans.
Barium	Barium is present in CRT's to protect users from radiation. It's not as beneficial in landfills or your drinking water.

Burning computer components releases dioxins, furans, PCB's, and other toxins into the atmosphere, and also into the lungs of anyone nearby. Why would anyone incinerate a PC? It's the cheapest, low-tech way to separate the worthless plastics from the salable metals. If you reside in a poor country without environmental and safety standards, this is how you separate and "recycle" materials. For example, yank the wires from desktops, then burn them to separate the worthless rubberized plastic coating from the salable copper within.

With over 1,000 different materials going into computer manufacture, it's not surprising many harmful elements are involved. You can encourgage manufacturers to limit the toxins they put into computer equipment. Just use the web tool called EPEAT to buy the most environmentally-friendly items. EPEAT has a database of several thousand computers and displays and rates them all on a variety of environmental criteria.

Where Do The Toxins End Up?

Where all the toxins in computers end up depends on many factors, one of which is the country disposing of them. In the United States, the Environmental Protection Agency estimates that less than 15% of e-waste is properly recycled. Of the remaining 85% that is improperly disposed of, some goes straight into landfills. Most goes overseas.

The overseas trade works like this. The U.S. imports billions of dollars of goods from China every year. All these items arrive in standard shipping containers. Since the U.S. exports very little back to China (as measured by volume), the majority of these shipping containers go back to China empty. So shipping to China is very inexpensive, and shipping even very low-value items there makes economic sense.

While Americans are eager to dispose of their toxic e-waste, China lacks the safety and environmental standards common to developed nations. And the Chinese labor rate is very low.

This combination of cheap shipping, inexpensive labor, and a lack of safety and environmental law breeds a thriving export trade. Computers and other e-waste goes to China and sometimes Africa where it is "recycled" with a complete lack of environmental and safety rules.

A few pictures tell the story. Here's how your old monitor is dissassembled to get at the valuable copper inside. Workers lack protection against inhaling the phosphorus dust coating on the inside of the display screen:

These Nigerian children pose in front of open-air e-waste burning next to their home:

This former farmer is picking chips off circuit boards by bathing them in acid. He has no protection from the acid fumes:

These pictures are courtesy of Basel Action Network ((c) 2010), an organization dedicated to eliminating these practices.

Of course, any economic activity has its downsides and scofflaws. The critical question is: how prevalent is this export trade? How much American e-waste ends up being improperly recycled in China and Africa?

The firms engaged in this toxic trade try to hide what they're doing, so one can only estimate. I've found responsible estimates asserting that from 50% to 80% of American e-waste goes into this business. The phenomenon has become so prevalent that it has been exposed repeatedly in the media. Check out 60 Minutes, NPR, PBS Frontline, CNN, BBC World News, and the Huffington Post.

This trade has become a thriving business. Companies called "fake recyclers" approach well-meaning organizations -- charities, churches, and community organizations -- and offer to hold a Recycling Day. The charity provides publicity, legitimacy, and a parking lot for the event. On the designated day, well-meaning residents drop off their old electronics for recycling. The fake recycler picks it up in their trucks, hauls it away for shipping, and makes money by exporting it to Chinese or African "recycling" centers. Nobody's the wiser.

This story, for example, describes how alleged fake recycler EarthEcycle approached the Humane Society, the Make-A-Wish Foundation, and the Boy Scouts of America for a "recycling" event. Seven e-waste containers were traced to Hong Kong and South Africa.

Organizations with outstanding reputations are conned into participating in this business while believing they are engaging in beneficial activity. It's not their fault. Since fake recycling is unregulated by U.S. law, anyone is free to call themselves a recycler and sell materials into the overseas trade. Misrepresentation about it is not illegal. Fake recycling is a thriving business.

It's Not Illegal?

Given that U.S. environmental practice has dramatically improved since the first Earth Day in 1970, one might wonder that fake recycling is legal. In fact, the international community devised a set of rules and agreements to control e-waste disposal and make sure that it's done properly. Generically called the Basel Conventions, these were initiated in 1989 in Basel, Switzerland, and have evolved forward since then.

Over 150 nations around the world adhere to the Basel Conventions. The United States is one of four that have not ratified -- and do not adhere to -- these international agreements. These charts show that the United States is the international "bad boy" of computer recycling. While one can only speculate as to why this is, it does seem clear that U.S. policy is captive to lobbyists and driven by narrow special interests.

It costs several dollars per item to properly dispose of much e-waste, and our society has decided not to pay that price. Instead those costs are imposed on the environment and those who work overseas in unsafe and unhealthy conditions.

What You Can Do

If you want to rectify this situation, educate yourself, then become socially and politically active. The public looks to IT professionals, industry participants, computer engineers and hobbyists for special understanding on technical issues. Legislators look to us for leadership. If the computer-savvy community remains ignorant, rest assured these practices will not change.

Computer community leaders have already scored major successes. One example are vendor "take back" programs, where computer manufacturers and sellers take back used equipment for recycling. A decade ago few programs existed. Today all major companies have take back programs. Several vendors have recently announced that their programs specifically forbid export recycling, and as the word about fake recycling spreads and public awareness builds, others will likely follow.

If you have an old computer you no longer use, please do not let it sit in your attic or basement. As a volunteer at the non-profit computer refurbisher Free Geek Chicago, I often receive donations that we could have fixed up and gotten to the needy -- had they not been aged in storage for several years.

As IT professional, computer expert or hobbyst, you use current equipment. Please understand that a computer you discard may be useful to others. About one-quarter of Americans do not own a computer. For many, a five to ten year old machine for basic activities like web surfing, word processing, and email means they don't have to trek to the public library or wait at school to use a shared computer. An older computer makes an excellent secondary machine for a large family. We have such demand for laptops at Free Geek that even Pentium II laptops find immediate placement.

For any computer you want to dispose of, please donate it to a refurbisher rather than to a recycler. A refurbisher reuses the equipment, while a recycler destroys it and reuses the component materials. Vendor take-back programs do not refurbish because they can not afford the labor to do this. They only recycle. But there are many non-profit refurbishers. You can find refurbishers to donate your old computer to here, here, and here.

Ask any refurbisher how far back they can reuse equipment. Organizations such as Free Geek can reuse computers up to ten years old (Pentium III's or better). Our "secret sauce" is a lightweight Linux distribution. Most refurbishers only reuse about five years back. Your goal should be to get a reburisher that reuses rather than recycles what you have to donate.

If your equipment is too old to be refurbished, how do you avoid fake recyclers? It can be difficult to identify them because most know full well that the public would be repulsed if they knew what their business entailed. They hide what they do. So you have to look for red flags. One red flag is that they accept CRT display monitors, TV's, and computer printers for free. These items can almost never be reused, and it costs money to environmentally recycle them. Organizations that environmentally recycle these items take a monetary loss on them if they don't ask for a small recycling fee. Printer disposal costs are usually about $3 to $10, and monitor and TV fees, $10 to $20.

Inspect the recycler's website. If it does not show photos of "the crusher" and other de-manufacturing equipment, be suspicious. Fake recyclers post happy pictures of trucks

eagerly hauling e-waste and nice stacks of computers in their building awaiting "recycling." What you're really seeing is collection and a distribution point for overseas shipping.

Finally, look for Basel Action Network's E-Steward certification program. This initiative certifies recyclers through strict standards. Unfortunately the program is new and the certification process is rather involved. So there are many worthy refurbishers and recyclers that the program does not list.

Recycle electronics
Electronics should be recycled in order to prevent the harmful accumulation of these substances in our landfills. There are both ‘clean’ and appropriate methods to recycle electronics, and also ‘dirty’, or unsafe ways to recycle these substances.

Clean recycling
An example the Silicon Valley Toxics Coalition gives of a clean method of recycling electronics is practiced by Micro Metalics, which processes used HP Computers. This organization is located in the United States, the workers are unionized and are involved in the safety board of the organization. Further, the recycling system is mechanized, there is an Intranet where workers can research safety issues if they care to. Similarly, as the European Union has banned the disposal of electronic waste in landfills, and has similarly banned the exportation of this waste to other countries for processing , they should have similar ‘clean’ systems set up.

Dirty recycling
Domestic ‘dirty’ recycling
According to the Silicon Valley Toxics Coalition and The Computer TakeBack Campaign (2003) – American prisoners in the Atwater prison in California are employed for $.20 - $1.26/hour to recycle electronics. These workers work in poor, and dangerous conditions. For example, as prisoners are not allowed to work with heavy machinery, they must break the electronics apart by hand with hammers, which naturally leads to frequent lacerations and exposure to substances. Furthermore, these prisoners are not protected by the same environmental laws enjoyed by U.S. citizens, there is a lack of disclosure practices in these prisons, and workers do not have a strong voice to advocate for reform of this system. While there has been little to no study of prison workers’ health, it is known that the potential for exposure to hazardous substances is great. As an inmate at this prison who states, “Even when I wear the paper mask, I blow out black mucus from my nose everyday?

International ‘dirty’ recycling
The United States does export a significant amount of our electronics overseas for developing countries to process, as it is costly to cleanly recycle materials, and it is not unheard of for some developing nations to bypass environmental regulations for economic gain. Such countries where exportation is common include China, Taiwan, Nigeria, India, and Kenya.

ICT recycling methods

Consumer recycling

Consumer recycling options consists of (see below) sale, donating computers directly to organizations in need, sending devices directly back to their original manufacturers, or getting components to a convenient recycler or refurbisher.

Corporate recycling

Businesses seeking a cost-effective way to recycle large amounts of computer equipment responsibly face a more complicated process.

Businesses also have the options of sale or contacting the Original Equipment Manufacturers (OEMs) and arranging recycling options.

Some companies pick up unwanted equipment from businesses, wipe the data clean from the systems, and provide an estimate of the product's remaining value. For unwanted items that still have value, these firms buy the excess IT hardware and sell refurbished products to those seeking more affordable options than buying new.

Companies that specialize in data protection and green disposal processes dispose of both data and used equipment, while employing strict procedures to help improve the environment. Professional IT Asset Disposition (ITAD) firms specialize in corporate computer disposal and recycling services in compliance with local laws and regulations and also offer secure data elimination services that comply with Data remanence standards including National Institute of Standards and Technology.

Corporations face risks both for incompletely destroyed data and for improperly disposed computers. In America, companies are liable for compliance with regulations even if the recycling process is outsourced under the Resource Conservation and Recovery Act. Companies can mitigate these risks by requiring waivers of liability, audit trails, certificates of data destruction, signed confidentiality agreements, and random audits of information security. The National Association of Information Destruction is an international trade association for data destruction providers.

Sale

Online auctions are an alternative for consumers willing to resell for cash less fees, in a complicated, self-managed, competitive environment[16] where paid listings might not sell. Online classified ads can be similarly risky due to forgery scams and uncertainty.

Takeback

When researching computer companies before a computer purchase, consumers can find out if they offer recycling services. Most major computer manufacturers offer some form of recycling. At the user's request they may mail in their old computers, or arrange for pickup from the manufacturer.

Hewlett-Packard also offers free recycling, but only one of its "national" recycling programs is available nationally, rather than in one or two specific states. Hewlett-Packard also offers to pick up any computer product of any brand for a fee, and to offer a coupon against the purchase of future computers or components; it was the largest computer recycler in America in 2003, and it has recycled over 750,000,000 pounds (340,000,000 kg) of electronic waste globally since 1995. It encourages the shared approach of collection points for consumers and recyclers to meet.

Exchange

Manufacturers often offer a free replacement service when purchasing a new PC. Dell Computers and Apple Inc. take back old products when one buys a new one. Both refurbish and resell their own computers with a one-year warranty.

Many companies purchase and recycle all brands of working and broken laptops and notebook computers, from individuals and corporations. Building a market for recycling of desktop computers has proven more difficult than exchange programs for laptops, smartphones, and other smaller electronics. A basic business model is to provide a seller an instant online quote based on laptop characteristics, then to send a shipping label and prepaid box to the seller, to erase, reformat, and process the laptop, and to pay rapidly by cheque. A majority of these companies are also generalized electronic waste recyclers as well; organizations that recycle computers exclusively include Cash For Laptops, a laptop refurbisher in Nevada that claims to be the first to buy laptops online, in 2001.

Scrapping/recycling

The rising price of precious metals — coupled with the high rate of unemployment during the Great Recession — has led to a larger number of amateur "for profit" electronics recyclers. Computer parts, for example, are stripped of their most valuable components and sold for scrap. Metals like copper, aluminum, lead, gold, and palladium are recovered from computers, televisions and more

Good

Wrong

Why is it important to recycle computer equipment?

Also known as *e-waste*, discarded computer equipment comprises monitors, printers, hard drives and circuit boards. Such items should on no account be thrown out with your household rubbish because they contain toxic substances, and are effectively hazardous waste. E-waste often ends up in the developing world, and the UN's Environment Programme is alarmed by the amount of electronic goods which is improperly disposed of overseas. There is increasing concern about the pollution caused by hazardous chemicals and heavy metals in Africa, Asia and South America.

What is in my PC?

Material	**Proportion**
Plastic	23,00%
Ferrous metals	32,00%
Non-ferrous metals	18,00%
Electronic boards	12,00%
Glass	15,00%

New legislation

New legislation came into force in 2007 to cover waste electrical and electronic equipment (WEEE). The regulations have significant implications for those who treat or recover WEEE and stipulate that users must store, collect, treat, recycle and dispose of WEEE separately from other waste. It is now a requirement that you obtain and keep proof that your WEEE was given to a waste management company, and was treated and disposed of in an environmentally sound way.

Disposal options

You can dispose of computer waste by returning the product to the manufacturer, taking the item to a professional waste disposal facility or donating the goods to a non-profit organisation.

Manufacturer disposal

Increasingly, manufacturers of electronic goods incorporate e-waste management into their environmental policies and operate consumer recycling schemes. Dell, for example, cover the cost of home pick-up, shipping to the recycling centre, and recycling of any obsolete equipment. The goods are “de-manufactured”, and sorted according to type or material. Materials like steel and aluminium are then re-cycled to make new products, from car parts to plastic toys. Meanwhile non-reusable substances are disposed of in an environmentally sound manner. Another big brand, Hewlett Packard, recycled over 74 million kilograms of electronics in 2005. Since beginning the program 20 years ago, HP has expanded recycling operations to more than 40 world regions. These schemes help to:

- reduce of the volume of waste which ends up in landfill sites
- cut down on the amount of raw materials needed for the manufacture of new products
- make recycling convenient for the consumer

Professional waste disposal

The process is the same as with a manufacturer scheme, but you may have to pay for collection and disposal of the waste. There are quite a few waste disposal cowboys out there, so you should check that the company:

- complies with WEEE and other relevant legislation.
- can provide details of their own Waste Carriers License, and details of any overseas partners they may use.

Donation to charity

A number of non-profit organisations collect electronic equipment including computers and printers, either for reuse or for de-manufacture and recycling. Recipients pay nothing for the equipment or buy it at a heavily discounted rate. Developing countries benefit most from these schemes, but recipients also include UK community groups.

If you decide to donate your PC to charity, be sure to check that:

- Appropriate security measures are in place to prevent unauthorised access, alteration or accidental loss or destruction of personal data, which is a legal requirement under the 1998 Data Protection Act. Reformatting the hard drive is not sufficient to permanently destroy all data.
- The organisation has a strategy for waste management once the PC becomes obsolete. It’s all very well sending computers to Nigeria to help train students in IT, but what happens when the equipment becomes obsolete? Is there a programme for disposal or will your donation just end up as e-waste in a backyard 3000 miles away?

In the UK there are now more than fifty non-profit organisations which collect, refurbish and supply PCs. A well-established choice is Computer Aid International, which has distributed over 150,000 PCs in over 100 countries, making it the global leader in not-for-profit supply of IT equipment.

OFFERS/Ex-IT is a a London based reuse/recycling project which has been set up to assist students, people on low income, Voluntary Sector Organisations (VSO's), small start-up businesses to gain access to low cost ICT and office furniture. The project has been in action since 1996, and as a whole has helped over 5000 VSO's, small businesses and students to gain access to low cost, reliable ICT and office fittings.

The project's main objective is to divert WEEE (Waste Electrical and Electronic Equipment) and surplus office fittings and furniture away from landfill and back into reuse. They make recycling very easy by even arranging collections of computers, consumer electronics and office furniture.

Digital Links is a registered charity and provides an IT disposal service to British schools and companies. Digital Links redistributes the computers to schools and community projects in the developing world. At present they have already distributed over 75,000 computers in just five years.

Cambridgeshire-based Reboot specialises in recycling donated IT equipment securely to EU WEEE directive and Environment standards. The organisation is a social enterprise offering a range of services from refurbishing a laptop to recycling the parts of multiple computers, priding themselves on a zero landfill policy. By accepting donations Reboot is able to provide a safe working environment and volunteering opportunities for people with learning disabilities and those who have difficulties finding work within the region.

Ilustration


COMPAQ

Citation

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