

## Lab - Design and Build a Small Network (Instructor Version)

**Instructor Note:** Red font color or gray highlights indicate text that appears in the instructor copy only.

### Objectives

Explain how a small network of directly connected segments is created, configured, and verified.

### Background /Scenario

**Note:** This activity is best completed in groups of 2-3 students.

Design and build a network from scratch.

- Your design must include a minimum of one Cisco 4321 router, two Cisco 2960 switches, and two PCs.
- Fully configure the network and use IPv4 or IPv6 (subnetting must be included as a part of your addressing scheme).
- Verify the network using at least five show commands.
- Secure the network using SSH, secure passwords and console passwords (minimum).

Create a rubric to use for informal peer grading. Present your Capstone Project to the class and be able to answer questions from your peers and Instructor!

**Instructor Note:** This optional Modeling Activity is suggested to be a graded assignment after completing all the chapters. Students should be able to show how small networks are designed, configured, verified, and secured. Documentation is a large factor of this project and students must be able to explain their network design and verification using **show** commands.

### Required Resources

- Packet Tracer
- Student/group-created rubric for assessment of the assignment

### Reflection Questions

1. What was the most difficult portion of this activity?

**Answers will vary.**

2. Why do you think network documentation is so important to this activity and in the real world?

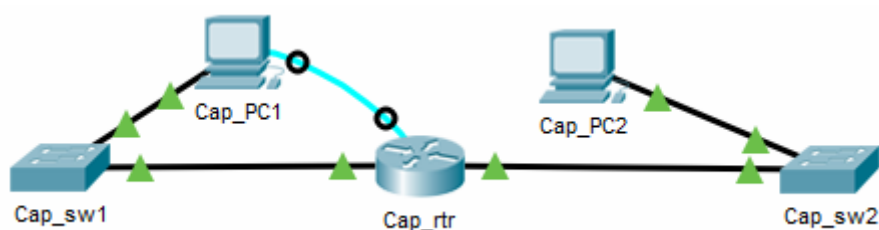
**Documentation is imperative to good network management and without it, network administrators have to recreate topologies, physically check addressing, etc. This takes time, which could be used elsewhere.**

**A suggested rubric and documentation examples are provided below:**

**Note: This rubric includes a total of 100 points for the points earned category (if minimum standards are met). Instructors may wish to consider adding bonus points for additional/advanced work in any requirement category.**

Requirement	Points Earned
Physical Topology – minimum 1 Cisco 4321 router, 2 Cisco 2960 switches, 2 PCs	(20 suggested)
Logical Addressing – subnetting used?	(20 suggested)
Connectivity test – ping the router	(20 suggested)
Show commands (at least 5 documented as baseline)	(20 suggested)
Security – SSH, secure passwords, console security – documented by show running-configuration	(20 suggested)

Create a small network of directly connected segments, at a minimum 1 router, 2 switches and 2 PCs, and include a screenshot of the network in your final documentation.



Configure the network to include switches, routers, and end devices and use your own network addressing. You must use subnetting of some type and you can use either IPv4 or IPv6 logical addressing. Create a table showing your physical addressing scheme for the router, switch, and PC and include it in your final documentation.

Device Name	IP Address	Subnet Mask
Cap_rtr	G0/0/0 – 192.168.1.1	255.255.255.224
	G0/0/1 – 192.168.1.33	255.255.255.224
Cap_sw1	VLAN1 – 192.168.1.20	255.255.255.224
Cap_sw2	VLAN1 – 192.168.1.62	255.255.255.224
Cap_PC1	F0 – 192.168.1.10	255.255.255.224
Cap_PC2	F0 – 192.168.1.40	255.255.255.224

Verify the network by using show commands (at least 5) to provide a performance baseline. Be able to discuss why you chose the show commands you selected and what the output means (use all Packet Tracer activities for Chapters 1-17). Keep screenshots of your output and include in your final documentation.

Cap\_rtr# show arp

Protocol	Address	Age (min)	Hardware Addr	Type	Interface
Internet	192.168.1.1	-	00D0.9741.9101	ARPA	GigabitEthernet0/0/0
Internet	192.168.1.10	1	000A.4120.9039	ARPA	GigabitEthernet0/0/0
Internet	192.168.1.33	-	00D0.9741.9102	ARPA	GigabitEthernet0/0/1
Internet	192.168.1.40	1	00D0.BCC3.BBEB	ARPA	GigabitEthernet0/0/1
Internet	192.168.1.62	0	0060.4779.5A11	ARPA	GigabitEthernet0/0/1

Cap\_rtr# show int g0/0/0

```
GigabitEthernet0/0/0 is up, line protocol is up (connected)
Hardware is Lance, address is 00d0.9741.9101 (bia 00d0.9741.9101)
Internet address is 192.168.1.1/27
MTU 1500 bytes, BW 1000000 Kbit, DLY 100 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Full-duplex, 100Mb/s, media type is RJ45
ARP type: ARPA, ARP Timeout 04:00:00,
Last input 00:00:08, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 27 bits/sec, 0 packets/sec
5 minute output rate 23 bits/sec, 0 packets/sec
8 packets input, 1024 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 input packets with dribble condition detected
7 packets output, 896 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```

Cap\_rtr# **show ip route**

```
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

Gateway of last resort is not set

```
192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
C 192.168.1.0/27 is directly connected, GigabitEthernet0/0/0
L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/0
C 192.168.1.32/27 is directly connected, GigabitEthernet0/0/1
L 192.168.1.33/32 is directly connected, GigabitEthernet0/0/1
```

Cap\_sw1# **show vlan brief**

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gig0/1, Gig0/2
1002	fddi-default	active	
1003	token-ring-default	active	

```
1004 fddinet-default      active
1005 trnet-default        active
```

```
Cap_sw2> traceroute 192.168.1.10
```

```
Type escape sequence to abort.
```

```
Tracing the route to 192.168.1.10
```

```
 1 192.168.1.33 39 msec 0 msec 0 msec
 2 192.168.1.10 13 msec 21 msec 15 msec
```

**Secure the network using common configuration to include SSH, secure passwords, console security, etc. and verify the commands configured by enacting a show running-configuration screen as output. Include in your final documentation.**

```
Cap_rtr# show run
```

```
Building configuration...
```

```
Current configuration : 831 bytes
```

```
!
```

```
version 15.4
```

```
no service timestamps log datetime msec
```

```
no service timestamps debug datetime msec
```

```
service password-encryption
```

```
!
```

```
hostname Cap_rtr
```

```
!
```

```
enable secret 5 $1$mERr$5.a6P4JqbNiMX0lusIfka/
```

```
!
```

```
ip cef
```

```
no ipv6 cef
```

```
!
```

```
username SSHAdmin secret 5 $1$mERr$WvpW0n5HghRrqnrxXCUU1.
```

```
!
```

```
ip domain-name capstone.lab
```

```
!
```

```
spanning-tree mode pvst
```

```
!
```

```
interface GigabitEthernet0/0/0
```

```
ip address 192.168.1.1 255.255.255.224
```

```
duplex auto
```

```
speed auto
```

```
!
```

```
interface GigabitEthernet0/0/1
```

```
ip address 192.168.1.33 255.255.255.224
```

```
duplex auto
```

```
speed auto
```

```
!
```

```
interface Vlan1
```

```
no ip address
```

```
shutdown
```

```
!
```

```
ip classless
```

```
!  
ip flow-export version 9  
!  
!  
line con 0  
password 7 0822455D0A16544541  
login local  
!  
line aux 0  
!  
line vty 0 4  
password 7 0822455D0A16544541  
login local  
transport input ssh  
!  
!  
end  
Cap_rtr#
```

**Identify elements of the model that map to real-world applications:**

All facets of this activity map to IT-related content and real-world applications because this is a culminating activity for all the Chapters.