Assignment A1

Network Cabling & LAN Setup

Aim

Part A: Setup a wired LAN using Layer 2 Switch and then IP switch of minimum four computers. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrate the PING packets captured traces using Wireshark Packet Analyzer Tool.

Part B: Extend the same Assignment for Wireless using Access Point

Motivation: Learn to setup wired and Wi-Fi office/organization network

Outcome: Students will able to setup wired and Wi-Fi network

Equipments Required

- Cat 3, Cat 5, Cat 5e Cat 6a Cables and RJ45 Connectors
- Crimping Tool
- Line Tester
- One server Node with Open Source and Internet Support
- HTTP Server (Apache) with Website pages of your Institute
- Four Client Nodes with Wi-Fi Support
- Wireshark Protocol Analyzer on all nodes
- Layer-II Switch
- Layer-III IP Switch
- Wi-Fi Access Point 2.4 GHz
- High Gain Wireless USB Adapter (Repeater)
- IP Address Configuration Chart

Procedure:

A. Cable crimping

Cable Preparation



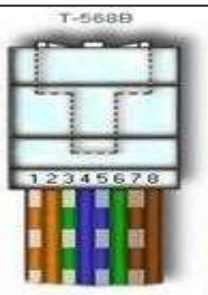

Orange – 1 & 2 Green – 3 & 6 Blue- 4 & 5 Brown- 7 & 8

TIA/EIA 568A and 568B Wiring Standards

Pin Diagram TIA/EIA 568-A

PIN	F()	Pair	Polarity	COLOR	A	
1	Rx	3	Rx+	Green/White	G	
2	Rx	3	RX-	Green	G	
3	Tx	2	Tx+	Orange/White	O	
4	-	1	Not Used	Blue	B	
5	-	1	Not Used	Blue/White	B	
6	Tx	2	Tx-	Orange	O	
7	-	4	Not Used	Brown/White	B	
8	-	4	Not Used	Brown	B	

Pin Diagram TIA/EIA 568-B

PIN	F()	Pair	Polarity	COLOR	A	
1	Tx	2	Tx+	Orange/White	O	
2	Tx	2	Tx-	Orange	O	
3	Rx	3	Rx+	Green/White	G	
4	-	1	Not Used	Blue	B	
5	-	1	Not Used	Blue/White	B	
6	Rx	3	Rx-	Green	G	
7	-	4	Not Used	Brown/White	B	
8	-	4	Not Used	Brown	B	

B. Straight through Cable

You usually use straight cable to connect different type of devices. Both sides (side A and side B) of cable have wire arrangement with same color. (Either 568A or 568B on both end)

PIN DIAGRAM TIA/EIA 568-B FOR STRAIGHT-THROUGH CABLING

PIN	COLOR	
1	Orange/White	O
2	Orange	O
3	Green/White	G
4	Blue	B
5	Blue/White	B
6	Green	G
7	Brown/White	B
8	Brown	B

	PIN	COLOR
O	1	Orange/White
O	2	Orange
G	3	Green/White
B	4	Blue
B	5	Blue/White
G	6	Green
B	7	Brown/White
B	8	Brown

Either 568A or 568B on both end

Pin number	Wire Color
Pin 1 ==>	Orange/White
Pin 2 ==>	Orange
Pin 3 ==>	Green/White
Pin 4 ==>	Blue
Pin 5 ==>	Blue/White
Pin 6 ==>	Green
Pin 7 ==>	Brown/White
Pin 8 ==>	Brown

Straight-Through

Wire	Becomes
1	1
2	2
3	3
6	6

Uses only Orange and Green Pairs

FOR DTE-DCE (Computer/Router To Modem/Hub/Switch)

Straight through cabling

i. Strip off insulation

ii. Untangle wires

iii. Place wires in correct order using either TIA/EIA 568A or 568B Standards & straighten. (Either 568A or 568B on both end)

iv. Trim wires to desired length.

Note: If the wires are too long the plug will not Crimp onto the insulation for strength.

v. Slide wires all the way into the RJ-45 connector. Make sure not to disrupt the color scheme and crimp it using crimping tool.

vi. Repeat steps 1-5 for the other end.

vii. Test wire using line tester equipment or between working computers and switch for patch (straight through) cables.

C. Cross Cable

Sometimes you will use crossover cable, it's usually used to connect same type of devices. In crossover cable we use 568A on one end and 568B on the other end or Vice Versa.

PIN DIAGRAM EIA/TIA 568B FOR CROSS-OVER CABLING

PIN	COLOR			COLOR	PIN
1	Orange/White	O	G	Green/White	1
2	Orange	O	G	Green	2
3	Green/White	G	O	Orange/White	3
4	Blue	B	B	Blue	4
5	Blue/White	B	B	Blue/White	5
6	Green	G	O	Orange	6
7	Brown/White	B	B	Brown/White	7
8	Brown	B	B	Brown	8

568A on one end and 568B on the other end or Vice Versa

Pin number	Wire Color
Pin 1 ==>	Orange/White
Pin 2 ==>	Orange
Pin 3 ==>	Green/White
Pin 4 ==>	Blue
Pin 5 ==>	Blue/White
Pin 6 ==>	Green
Pin 7 ==>	Brown/White
Pin 8 ==>	Brown

Crossed-Over

Wire	Becomes
1	3
2	6
3	1
6	2

Uses only Orange and Green Pairs

For DTE-DTE and DCE-DCE(Computer To Computer, Router To Router, Modem To Modem)
The wires to swap are One and three, Two and six

Cross cabling

i. Strip off insulation

ii. Untangle wires

iii. Place wires in correct order using TIA/EIA 568A and 568B Standards & straighten. (568A on one end and 568B on the other end or Vice Versa)

iv. Trim wires to desired length.

Note:

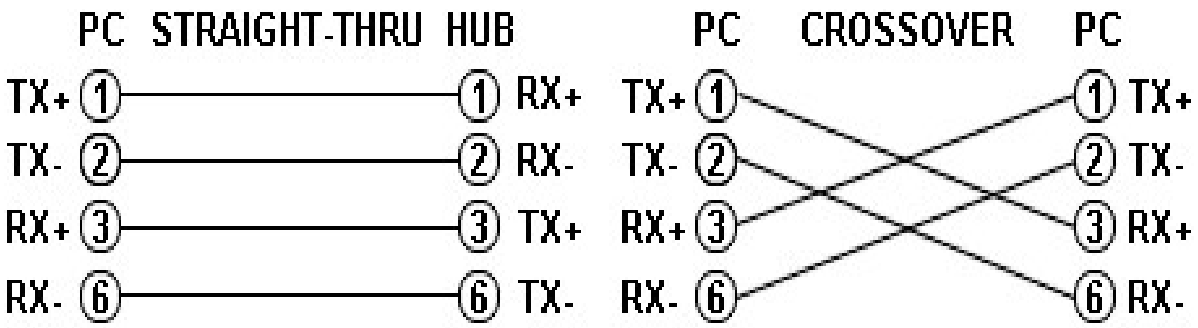
If the wires are too long the plug will not Crimp onto the insulation for strength.

v. Slide wires all the way into the RJ-45 connector. Make sure not to disrupt the color scheme and crimp it using crimping tool.

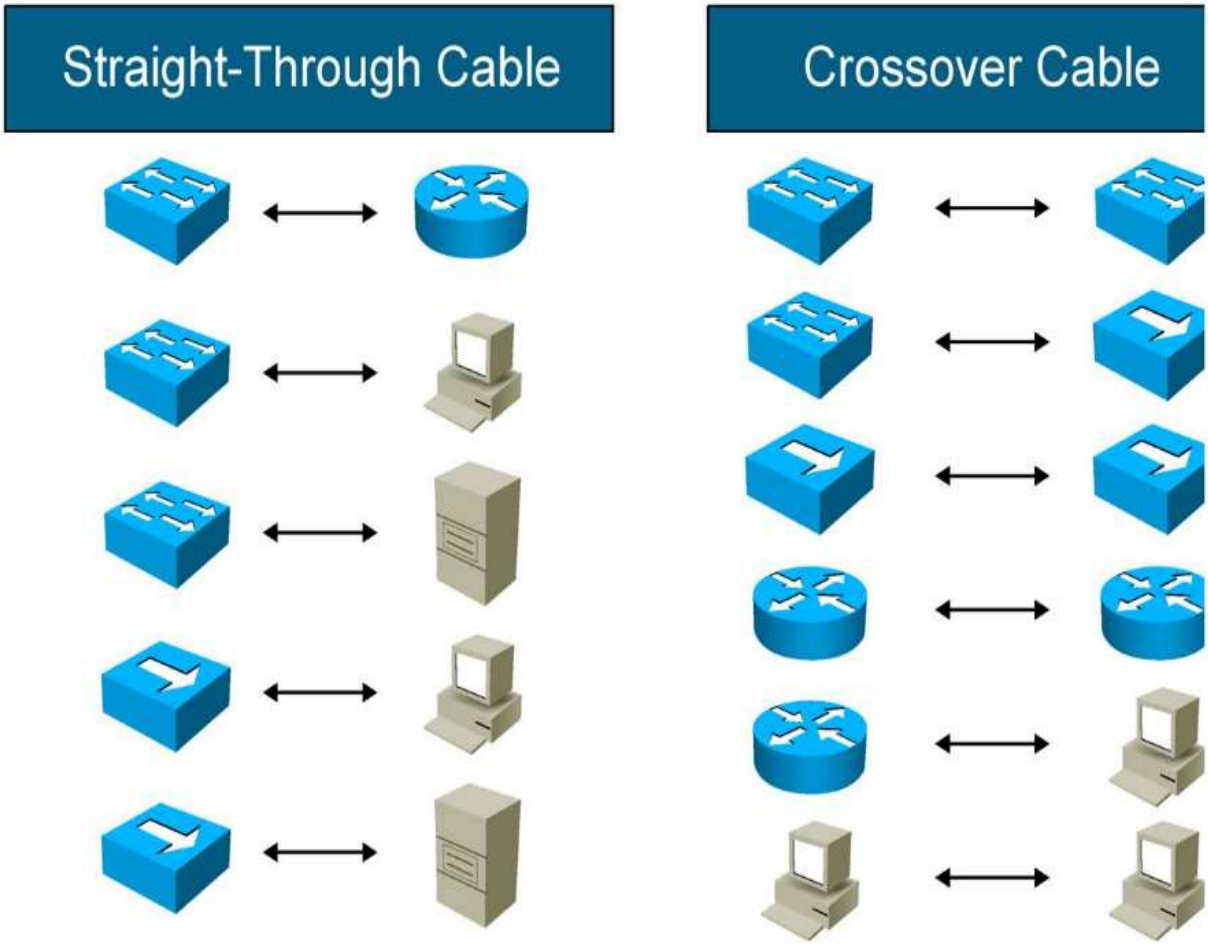
vi. Repeat steps 1-5 for the other end.

vii. Test wire using line tester equipment or between two PCs for crossover cables.

Figure Data Line in cable

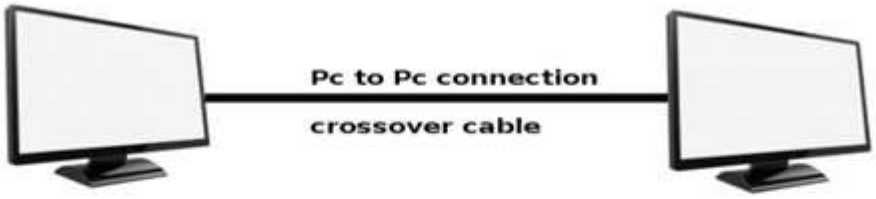


Uses of Cable



PART A: Setting up a wired LAN

Task I: Connect two PCs using Crossover Cable and check the reachability of hosts using ping command. Also capture the traces of ping using Wireshark Protocol Analyzer.



IP Address: 192.168.1.2
Subnet Mask: 255.255.255.0
Gateway: 192.168.1.1

ping 192.168.1.3

IP Address: 192.168.1.3
Subnet Mask: 255.255.255.0
Gateway: 192.168.1.1

ping 192.168.1.2

Capture the traces of ping using Wireshark Protocol Analyzer

Procedure:

For Both the PCs perform following steps.

A. NIC Card Installation

1. Unplug the PC from its electrical source, and remove all cords.
2. Open the case of the CPU with a screwdriver. Be careful of sharp metal edges. If the case doesn't open easily, check your operator's manual. There may be a release button that will open the case after the screws are undone.
3. Lay the CPU on its side. Locate the NIC slot. Align the NIC with the RJ45 jack facing the outside of the case. Firmly seat the card into the slot. You may have to rock it gently to get it to fit. The gold contacts should not be visible, and the NIC card should be level.
4. Secure the mounting bracket with screws. They should come with the NIC card.
5. Replace the cover. Securely reattach all cords.
6. Reboot the computer, and install the software that comes with the NIC card. This will install the necessary drivers. There will be prompts as the hardware installs. Simply follow the directions.

B. Physical Connection

Connect one RJ45 connector of Crossover Cable in the NIC Card of PC1 and another RJ45 connector in the NIC Card of PC2.

C. Configure IP addresses on PC1 and PC2

1. Open Network Connection in System Settings
2. Select Wired Network and Edit it
3. Configure following IPv4 addresses Save it
    a. For PC1
        i. IP Address: 192.168.1.2
        ii. Subnet Mask: 255.255.255.0
        iii. Gateway: 192.168.1.1
    b. For PC2
        i. IP Address: 192.168.1.3
        ii. Subnet Mask: 255.255.255.0
        iii. Gateway: 192.168.1.1

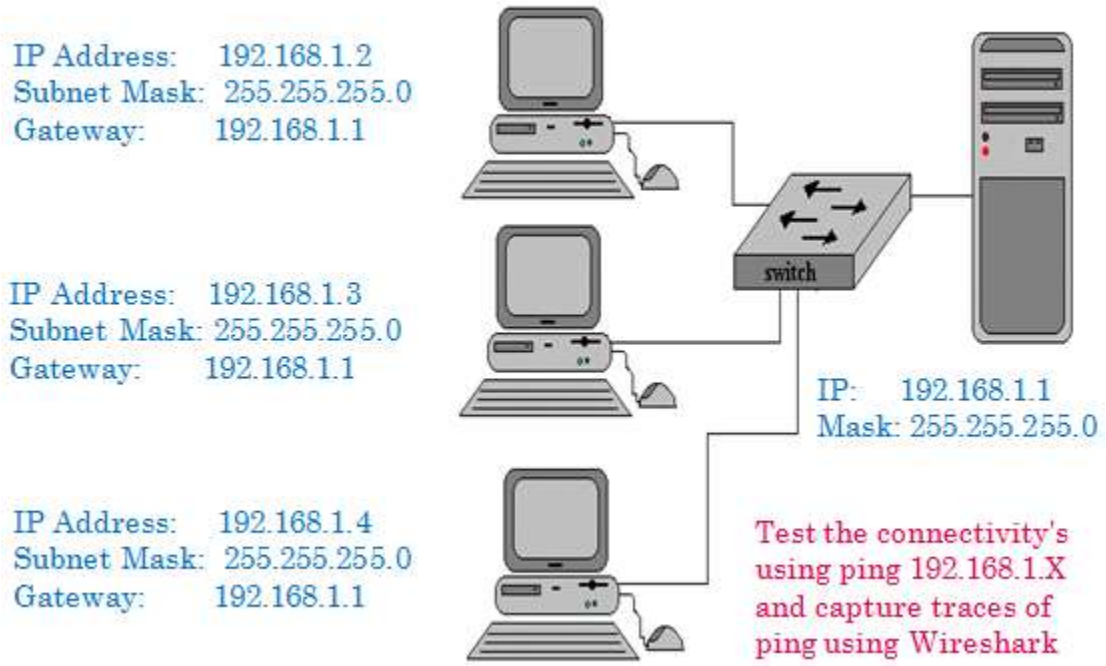
D. Check reachability of Hosts using ping command

1. Open terminal on PC1
2. Type ping 192.168.1.3 (IP Address of PC2) and press enter.

E. Capture ping traces

1. Run Wireshark Protocol Analyzer
2. Select Wired Ethernet Interface
3. Click on Start Button to Capture ping traces
4. Analyze Captured ping traces

Task II: Connect four PCs using Straight-Through Cable and check the reachability of hosts using ping command. Also capture the traces of ping using Wireshark Protocol Analyzer.



For each PC follow the following steps:

A. NIC Card Installation

Same as Task I

B. Physical Connection

1. Connect one RJ45 connector in the NIC Card of PC and another RJ45 connector in the switch.
2. Give power supply for the switch.

C. Configure IP addresses on all PCs

1. Open Network Connection in System Settings
2. Select Wired Network and Edit it
3. Assign following IPv4 Configurations and Save it
    a. For PC1
        i. IP Address: 192.168.1.2
        ii. Subnet Mask: 255.255.255.0
        iii. Gateway: 192.168.1.1

b. For PC2
    i. IP Address: 192.168.1.3
    ii. Subnet Mask: 255.255.255.0
    iii. Gateway: 192.168.1.1
c. For PC3
    i. IP Address: 192.168.1.4
    ii. Subnet Mask: 255.255.255.0
    iii. Gateway: 192.168.1.1
d. For PC4 (Server)
    i. IP Address: 192.168.1.1
    ii. Subnet Mask: 255.255.255.0

D. Check reachability of Hosts using ping command

1. Open terminal on PC1
2. Type ping 192.168.1.1 (IP Address of Server) and press enter.
3. Similarly use ping commands on other PCs to check the reachability of Hosts on LAN.

E. Capture ping traces

1. Run Wireshark Protocol Analyzer
2. Select Wired Ethernet Interface
3. Click on Start Button to Capture ping traces
4. Analyze Captured ping traces

Task III: Connect four PCs using Straight-Through Cable. Install Web Server on one PC and Test the Web Server by access web pages stored on Web Server from Clients (PC1, PC2 and PC3). Also capture the traces of http, tcp, ip and Ethernet-II using Wireshark Protocol Analyzer.

A. Physical Connection and IP configuration is same as Task II.

B. Installation of Web Server- Apache2 or Tomcat7

a. Install the server - sudo apt-get install apache2
b. Start web server - /etc/init.d/apache2 start
c. Create the web page and store in /var/www/html

d. Access the web pages from client machines 1/2/3

C. Capture the traces of http, tcp, ip and Ethernet-II using Wireshark Protocol Analyzer.

1. Run Wireshark Protocol Analyzer
2. Select Wired Ethernet Interface
3. Click on Start Button to Capture the traces of http, tcp, ip and Ethernet-II using Wireshark Protocol Analyzer.
4. Analyze Captured traces of http, tcp, ip and Ethernet-II using Wireshark Protocol Analyzer.

Conclusion: Set up Wired and Wireless LAN successfully and analyzed traces of ping using Wireshark.

FAQs

S. No.	Question	BT Level	Cognitive Level
1	What is a Layer 2 switch, NIC and WLAN Card?	Remember (L1)	Knowledge
2	Define IP address and its role in LAN setup.	Remember (L1)	Knowledge
3	What is the function of a line tester, RJ 45 connector, crimping tool in LAN cable preparation?	Understand (L2)	Comprehension
4	Explain following Linux Networking Commands: Ping, Traceroute, Telnet, Ifconfig nslookup, netstat, ifup, ifdown, route, dig, host, arp, hostname.	Understand (L2)	Comprehension
5	Differentiate TCP/IP Model & OSI Model?	Understand (L2)	Comprehension
6	How do you assign a static IP address to a computer?	Apply (L3)	Application
7	How will you use PING to check connectivity between two systems?	Apply (L3)	Application
8	Analyze the output of the ping command for packet loss and latency.	Analyze (L4)	Analysis
9	Why is it important to assign unique IP addresses to each device in a LAN?	Evaluate (L5)	Evaluation
10	Suggest an efficient IP addressing scheme (class with IP address) for a LAN of 4 computers and justify your choice.	Create (L6)	Synthesis