



# INSTITUTE OF ENGINEERING , CENTRAL CAMPUS,PULCHOWK

## COMPUTER NETWORK

LAB #1

---

# Study of Network Architecture with Network Devices and Cables

---

**Submitted BY:**

AMRIT PRASAD PHUYAL

Roll: PULL074BEX004

**Submitted To:**

SHARAD KUMAR GHIMIRE

Department of Electronics and  
Computer Engineering

October 14, 2020

# Contents

<b>1</b>	<b>Title</b>	<b>1</b>
<b>2</b>	<b>Objective</b>	<b>1</b>
<b>3</b>	<b>Requirement</b>	<b>1</b>
<b>4</b>	<b>Procedure</b>	<b>2</b>
<b>5</b>	<b>Exercises</b>	<b>4</b>
5.1	Question -1 . . . . .	4
5.2	Question -2 . . . . .	5
5.3	Question -3 . . . . .	6
5.4	Question -4 . . . . .	7
5.4.1	Repeater and Hub . . . . .	7
5.4.2	Bridge and Switch . . . . .	7
5.4.3	Repeater and Bridge . . . . .	8
5.4.4	Hub and Switch . . . . .	8
5.4.5	Switch and Router . . . . .	9
5.4.6	Router and Gateway . . . . .	9
5.5	Question -5 . . . . .	10
5.6	Question -6 . . . . .	10
<b>6</b>	<b>Conclusion</b>	<b>12</b>

## List of Figures

1	LAN Cable Tester . . . . .	2
2	Cable Crimping Tool . . . . .	3
3	Layered OSI Architecture . . . . .	4
4	Protocols in different TCP/IP layers . . . . .	5
5	T-568A and T-568B Color coding . . . . .	10
6	Difference in Straight through and Cross over . . . . .	11
7	Application of Straight through and Cross over . . . . .	11

## List of Tables

1	Comparision between Repeater and Hub . . . . .	7
2	Comparision between Bridge and Switch . . . . .	7
3	Comparision between Repeater and Bridge . . . . .	8
4	Comparision between Hub and Switch . . . . .	8
5	Comparision between Switch and Router . . . . .	9
6	Comparision between Router and Gateway . . . . .	9

# 1 Title

## Study of Network Architecture with Network Devices and Cables

# 2 Objective

- To be familiar with different layers of layered network architecture and need of logical address
- To be familiar with different network devices: repeater, hub, bridge, switch, router etc.
- To be familiar with Crimping tool, RJ-45 connector and different color coding of UTP network cable
- To be familiar with preparation of straight through and crossover cable and their uses

# 3 Requirement

- Network devices and cables
- Crimping tool
- RJ-45 connectors
- Computers
- Hub / Switch
- Pieces of UTP cable (CAT 5 or CAT 6)
- LAN cable tester

## 4 Procedure

As explained in Lab sheet provided we need layering in order to create modular environment in network so that change to any particular module doesn't affect other modules. TCP/IP module combine presentation, session layer of OSI in to application layer and similarly data link and physical layer to Networks access layer. There are different addressing in Different layers like MAC ,IP, Port address used by different devices like Router , Bridge, Switch, Repeater/Hub.

Like wise there are different category of UTP cable from CAT1 to CAT6 and more having different Data rate therefore different Application. Either T568A or T568B Standard has to be followed before crimping UTP cable inside RJ45 Connector. Furthermore, Connection can be either Straight-through( follows same orientation) or crossover cable ( 1 and 2 pins of one end connected to 3 and 6 pins of other).

Different Model of Lan Cable Tester are available in the market . the model we used in the lab was battery powered and has two detachable module. One of them with switch and bulky was Transmitter where as other was Receiver. It has 9 led lights in each module ( 8 pins of Rj45 port and Ground) and switch to initiate the testing.



Figure 1: LAN Cable Tester

For testing the LAN cable following steps has to be followed:-

1. Make sure both Ends are connected to their respective module(TX and RX). We have to release the Wire only after hearing the clicking sound on RJ45 port.
2. Note whether all 8 pins(led) light up , since we haven't connected any ground GND remains off. If the LEDs light up in order then Cable is alright and functioning and the connection is Single through. if not in order then there might be error during connection or the connection is Crossover.

In one of the wire provided in the LAB had mismatched connection so we corrected and tested it using Crimping tool and LAN tester. The crimping tool provided can do multitask like can strip jacket of wire using Stripper, can cut wire in equal length through cutter , crimping wire to Rj45 connector using crimper and many more.



Figure 2: Cable Crimping Tool

Following steps were followed in order to repair that faulty connection:-

1. One end of the wire was inserted to stripping section then squeezed and rotated which only cuts jacket and peels it off.
2. Then the wires were straighten and arranged in order and then cut evenly, leaving only about 13mm of wire hanging.
3. Tip of each wires were cut and copper was exposed , then inserted into the Rj45 connector such that the jacket also has space inside the connector.
4. It was then crimped using Crimping section of Crimping tool and tested further using LAN tester.

## 5 Exercises

### 5.1 Question -1

**What is layered network architecture? Why layering is important?**

*Answer:*

Network Architecture can be termed as framework that direct the design and its functionality. In layered network architecture the complex Network Architecture is divided into sequence of layer and each assigned with particular task. Here Particular layer only interact with layer above and below it only after following protocols. for example:- In OSI model architecture there are 7 layers namely :- Application, Presentation, Session, Transport, Network, Data link and Physical layer.

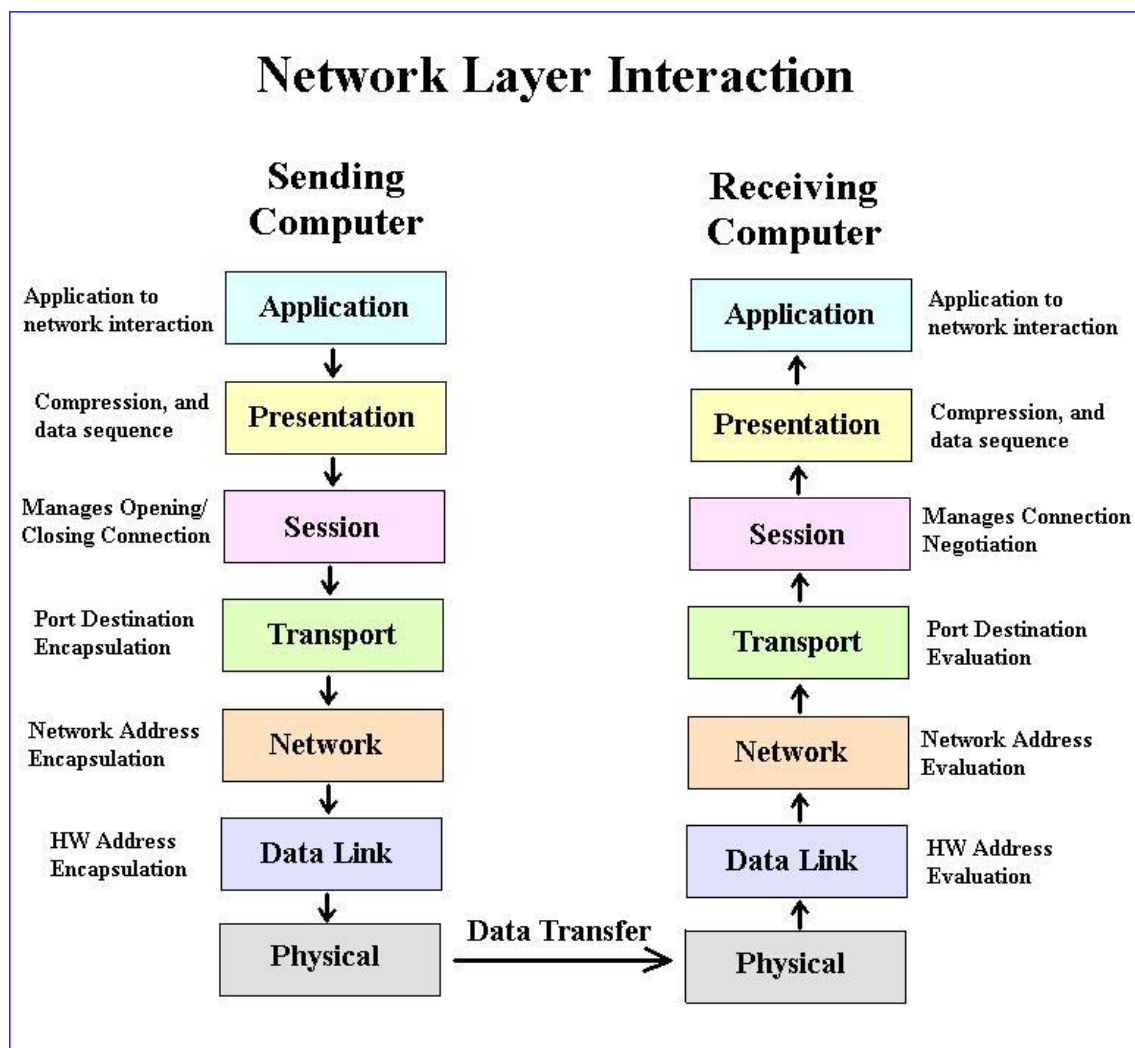


Figure 3: Layered OSI Architecture

In Network Architecture layering is important due to following reason:-

- Using layering complex network problems can be divided in to smaller manageable tasks.
- It provides the Modularity Features. Each layer is independent which makes easier to implement and maintain. Thus providing greater flexibility.



- Being the modular Design , the no. of equipment or protocol in particular layer can be altered as per the need.
- Being each layer independent , multiple vendors can provide support and develop the hardware .

## 5.2 Question -2

**What is protocol? List out ten different standard protocols having at least one in each layer of TCP/IP reference model.**

*Answer:*

Protocols are set of rules that need to be followed by electronics devices to format data, to transmit and receive data. Protocols includes Data format and commands to communicate.

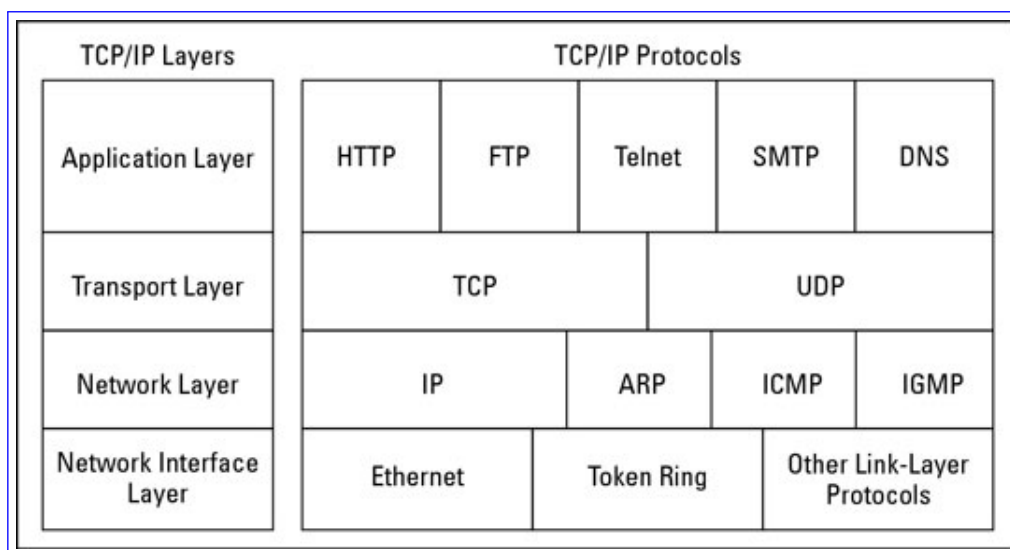


Figure 4: Protocols in different TCP/IP layers

Different Protocols used in TCP/IP layers are:-

- **Application:** NFS, NIS+, DNS, telnet, ftp, rlogin, rsh, rcp, RIP, RDISC, SNMP, HTTP, SMTP and others
- **Transport:** TCP, UDP
- **Internet:** IP, ARP, ICMP , IPV4, IPV6
- **Data Link:** PPP, IEEE 802.2 ,DSL
- **Physical Network:** Ethernet (IEEE 802.3) Token Ring, RS-232, others

### 5.3 Question -3

**List out the devices that can work up to physical, data link, network and application layer.**

*Answer:*

The devices in each Layers are listed below:-

#### 1. Physical

- Hubs: Connects Segments of LAN and has multiple I/O Ports.
- Cables: Physical connection between devices , may include Fibers, coaxial cables and twisted pair cables.
- Repeaters: Regenerate or Amplify the digital or Analog signals

#### 2. Data link

- Bridges: Provides interconnection with other network using same protocols.
- Modem: MODulator/DEModulator converts Analog signal to Digital and vice-versa.
- Network Interface Card (NIC): Device that connect hardware to Network.

#### 3. Network

- Routers: Forwards data Packets based on IP available in Routing Tables.

#### 4. Application

- Gateways: Protocols Converter which is part of two network using different protocols.
- Firewalls: Filters packets and prevent unauthorized access to and from Network
- All devices that Uses Internet, PCs ,Smartphone, Laptops etc..

## 5.4 Question -4

Compare the devices (showing the similarities as well as differences):

### 5.4.1 Repeater and Hub

KEYS	Repeater	Hub
<b>No. of ports</b>	One input and One output	One input and many output
<b>Wastage</b>	Doesnot cause wastage of bandwidth	Cause bandwidth wastage as it broadcast to all nodes available.
<b>Destination</b>	Doesnot check whether data reaches destination or not.	Doesnot check whether data reaches destination or not.
<b>Collision Domain</b>	Doesnot check for Collision Domain	Doesnot check for Collision Domain
<b>Security</b>	Not secure	Not secure

Table 1: Comparision between Repeater and Hub

### 5.4.2 Bridge and Switch

KEYS	Bridge	Switch
<b>Layer(OSI Model)</b>	Data link layer	Data link layer
<b>No. of Connec-tion</b>	Can connect fewer LAN	Can connect more than Bridge
<b>Error Checking</b>	Doesnot perform Error Checking	Perform Error Checking
<b>Function</b>	Channel Data from input port to de-sired output port	Divides network into segments
<b>Buffer</b>	May or maynot have buffer	Have buffer
<b>Speed</b>	Slower than switch	Faster than Bridge
<b>Table</b>	Use Address table	Use Switch table

Table 2: Comparision between Bridge and Switch

### 5.4.3 Repeater and Bridge

KEYS	Repeater	Bridge
<b>Layer(OSI Model)</b>	Physical layer	Data link layer
<b>NO. of ports</b>	One input and One output	One input and One output
<b>Collision Domain</b>	Doesnot check for Collision Domain	Check for Collision Domain
<b>Buffer</b>	Doesnot have Buffer	May or maynot have Buffer
<b>Tables</b>	Doesnt have any Tables	May or maynot have buffer
<b>Security</b>	Not secure	Secure
<b>Cost</b>	Cheaper	Expensive
<b>Use</b>	Extend LAN	Extend LAN
<b>Destination Address</b>	Can't determine destination address	Can determine destiantion address

Table 3: Comparision between Repeater and Bridge

### 5.4.4 Hub and Switch

KEYS	Hub	Switch
<b>Layer(OSI Model)</b>	Physical Layer	Data link layer
<b>Table</b>	Doesnot have tables for MAC address	Stores MAC address in Lookup Tables
<b>Transmission Form</b>	Electrical Signals and Bits	Frame Packets
<b>Transmission Mode</b>	Half Duplex	Full Duplex
<b>Connection and Collision Domian</b>	Can connects many networks devices together and prone to Collision Do-mian	Similar to Hub but prevent collisiain domian by directing data to only re-quested devices
<b>Security</b>	Not Secure	Can be secured using VLAN.
<b>Cost</b>	Cheaper	Expensive

Table 4: Comparision between Hub and Switch

### 5.4.5 Switch and Router

KEYS	Switch	Router
<b>Layers(OSI Model)</b>	Data link layer	Network layer
<b>Tables</b>	Switch table to store MAC	Routing table to store IP address
<b>NAT</b>	Cannot perform NAT	Can perform NAT
<b>Network Type</b>	Operate on Wired Network Only	Operate on Wireless and wired network
<b>Destiantion Address</b>	Knows destination address of data packet	Knows destination address of data packet
<b>Operation Area</b>	LAN	Used in all LAN, MAN ,WAN
<b>Transmission Mode</b>	Full duplex mode transmission	Full duplex mode transmission

Table 5: Comparision between Switch and Router

### 5.4.6 Router and Gateway

KEYS	Router	Gateway
<b>Layers(OSI Model)</b>	Network	All Layers
<b>Working</b>	Receive ,Analyze and Forward the data	Communication Among Networks using different protocols
<b>Function</b>	Route Traffice between the Network	Translate protocol
<b>Dynamic Routing</b>	Supported	Not Supported
<b>Hosted on</b>	Dedicated Application (Physical Hardware)	Can be on Dedicated Application , Physical server or Virtual Application
<b>Features</b>	DHCP.NAT.Static Routing,Wireless,IPV6,Mac filtering etc.	Voip to PSTn or Network Access Control

Table 6: Comparision between Router and Gateway

## 5.5 Question -5

**Why logical addressing is required in network communication? Explain briefly.**

*Answer:*

In networking there are two types of addressing Logical and Physical. Physical addressing uses manufacture assigned MAC address for identity where as Logical addressing uses virtual assigned IP address.

The main reason for using Logical address instead of MAC is to forward the traffic effectively across the globe. Manufacture assign consecutive product, the consecutive MAC address but those product may end on the opposite side of the globe. So, when Mac is used the data packet has to travel back and forth around the globe until it reaches the destination. In order to solve this issue Logical addressing is in use. It is assigned to a device as per their Location(ISP). so, the data packet intended for that device can first travel to ISP then to the device easily.

## 5.6 Question -6

**Where do you need straight-through and cross-over cable? Explain briefly.**

*Answer:*

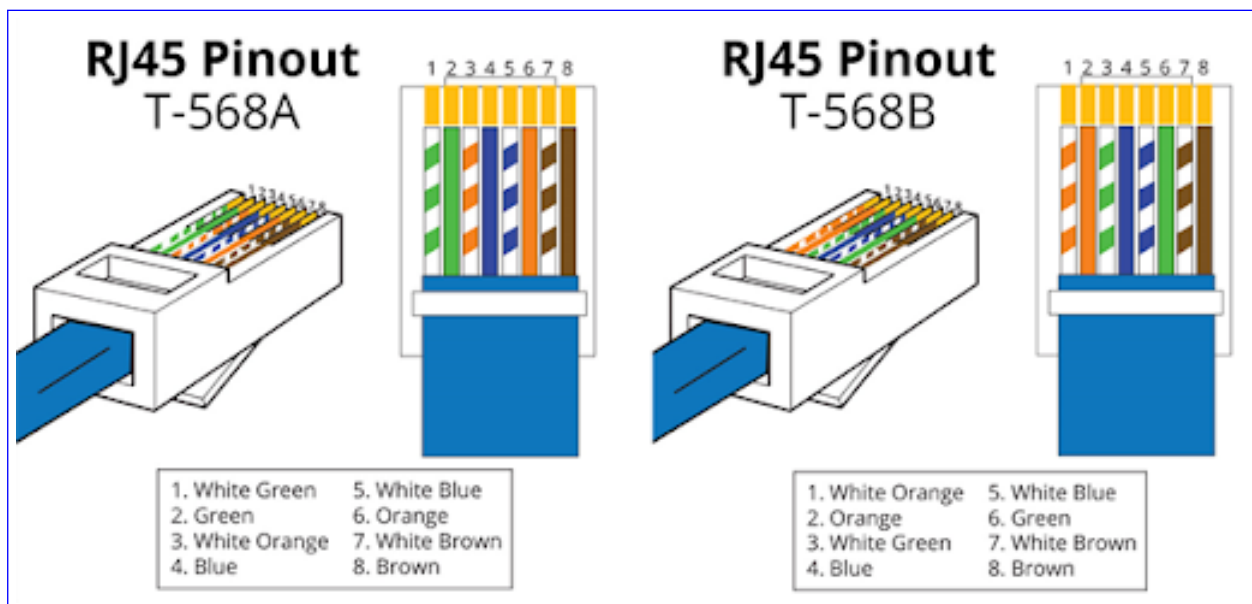


Figure 5: T-568A and T-568B Color coding

There are basically two wiring standard in Networking T-568A and T-568B following different color code. There are two wiring technique Straight through and Crossover Cable.

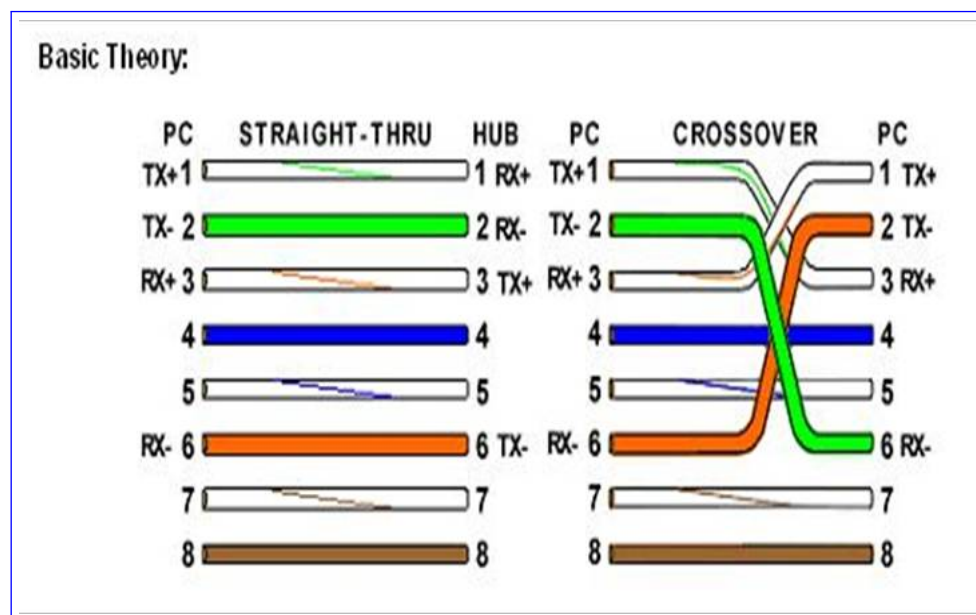


Figure 6: Difference in Straight through and Cross over

In straight through both ends of the wire follows the same wiring standard whereas in Crossover wiring standard of one ends doesn't match with others. To put in other words if pin 1 and 2 of one ends is connected to 3 and 6 of other then such connection Crossover.

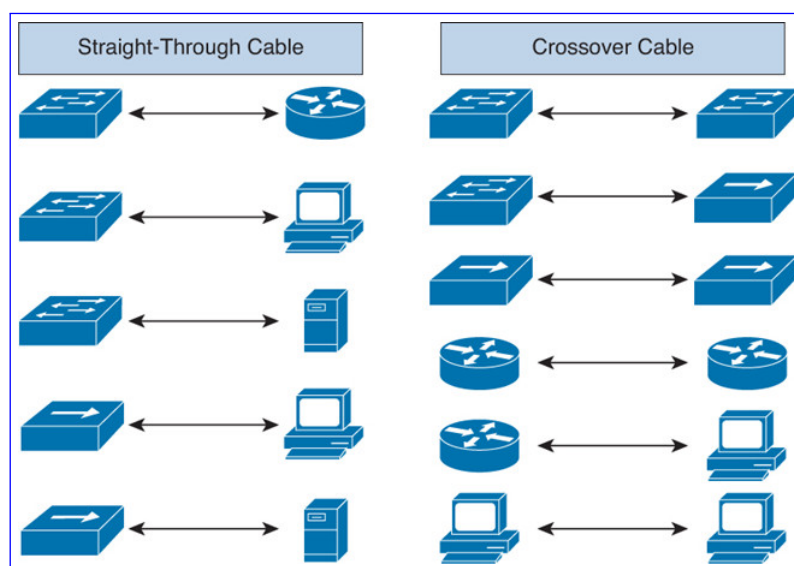


Figure 7: Application of Straight through and Cross over

DEVICES	Hub	Switch	Router	Workstation
Hub	Crossover	Crossover	Striaght	Striaght
Switch	Crossover	Crossover	Striaght	Striaght
Router	Striaght	Striaght	Crossover	Crossover
Workstation	Striaght	Striaght	Crossover	Crossover

## **6 Conclusion**

This lab started with introduction to Computer network and devices involved in different layers, like switch ,hub ,Routers and then we move to different cables and connectors and all the way to cable tester and Rj45 cable with Crimping tool. In this lab we also got familiar with Straight through and crossover cable connection and their practical uses.