SCHEME : K	Name :         Roll No. :Year : 20 20         Exam Seat No. :
DATA CO	ORY MANUAL FOR MMUNICATION AND NETWORK - 314318

## **COMPUTER ENGINEERING GROUP**



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI (Autonomous) (ISO 9001: 2015) (ISO/IEC 27001:2013)

#### Vision

To ensure that the Diploma level Technical Education constantly matches the latest requirements of Technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

#### Mission

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the challenging technological & environmental challenges.

#### **Quality Policy**

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

#### **Core Values**

#### **MSBTE** believes in the following:

- Skill development in line with industry requirements
- Industry readiness and improved employability of Diploma holders
- Synergistic relationship with industry
- Collective and Cooperative development of all stake holders
- Technological interventions in societal development
- Access to uniform quality technical education

## A Practical Manual for

# Data Communication and Computer Network

# (314318)

## **Semester-IV**

## AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH



## Maharashtra State Board of Technical Education, Mumbai

(Autonomous) (ISO 9001:2015) (ISO/IEC 27001:2013)

"K" Scheme Curriculum



#### Maharashtra State Board of Technical Education, Mumbai (Autonomous) (ISO 9001:2015) (ISO/IEC 27001:2013) 4<sup>th</sup> Floor, Government Polytechnic Building 49, Kherwadi, Bandra (East), Mumbai – 400051



## Maharashtra State Board of Technical Education Certificate

This is to certify that Mr./Ms Roll No
of the Fourth Semester of Diploma in
Engineering/Technology (Program Code4K) of the Institute
(Inst. Code) has completed the
practical work satisfactorily for the course Data Communication and Computer Network
(Course Code: 314318) for the academic year 20 20 as prescribed in the
curriculum.
Place Enrollment No
Date: Exam Seat No
Course TeacherHead of the DepartmentPrincipal
Seal of the Institute

### Preface

Data Communication and Computer Network (314318) laboratory manual is meticulously crafted to equip fourth semester diploma engineering students with valuable practical learning experiences aligned with MSBTE 'K' Scheme Curriculum.

The primary objective of this manual is to enhance valuable skills in data communication and computer network of diploma engineering students which is vital to excel at the workplace. To achieve this, each practical is mapped with prescribed theory learning outcomes (TLOs), lab learning outcomes (LLOs) and course outcomes (COs). Course facilitators can adopt suitable pedagogical methods to impart the course with an aim to achieve the prescribed course outcomes effectively.

This laboratory manual is designed to help all stakeholders, especially the students and teachers to develop in the student the pre-determined outcomes. Every practical in this manual begins by identifying the Practical Significance, Industry/Employer expected outcome, Course Level Learning Outcomes, and Laboratory Learning Outcomes which serve as a key focal point for doing the practical. The students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This laboratory manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students. Data communication deals with the transmission of digital data through a network. Many applications like Airline Reservations, Railway reservations, e-banking, e-governance, Online Shopping, e-learning can be managed by a single click. Diploma Engineers should be able to select, classify, install, troubleshoot and maintain different industrial data communication networks.

This laboratory manual gives the important concepts and techniques related to data communication and enable students to create, maintain and troubleshoot computer networks.

## **Program Outcomes (POs) to be achieved through Course:**

- **PO1** Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
- **PO2** Problem analysis: Identify and analyses well-defined engineering problems using codified standard methods.
- **PO3** Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
- **PO4** Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
- **PO5** Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.
- **PO6** Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
- **PO7** Life-long learning: Ability to analyses individual needs and engage in updating in the context of technological changes.

## **Practical Course Outcome Matrix**

## **Course Outcomes (COs)**

CO1	Analyze the functioning of Data Communication and Computer Network.
CO2	Select relevant Transmission Media and Switching Techniques as per need.
CO3	Analyze the Transmission Errors with respect to IEEE standards.
CO4	Configure different TCP/IP services.
CO5	Implement relevant Network Topology using Networking Devices.

Sr. No.	Title of the Experiment	CO1	CO2	CO3	CO4	CO5
1	* Amplitude Shift Keying(ASK) using any simulator	$\checkmark$				
2	Frequency Shift Keying(FSK) using any simulator	$\checkmark$				
3	Frequency Shift Keying(FSK) using any simulator	$\checkmark$				
4	*Create and Test standard straight network cable(Universal Colour Code) using crimping tool		$\checkmark$			
5	Create and Test standard Cross network cable(Universal Colour Code) using crimping tool		$\checkmark$			
6	* Generate a Time Division Multiplexing(TDM) signal using relevant simulation software		~			
7	*Create a Hybrid Network Using Bluetooth			$\checkmark$		
8	*Locate the error bit in the given data string by applying checksum error detection method			$\checkmark$		
9	*Implement Wireless network			$\checkmark$		
10	Write a 'C' program for parity check error detection			$\checkmark$		
11	*Write a 'C' program for Cyclic Redundancy Check(CRC) error detection			$\checkmark$		
12	*Write a 'C' program for error correction using Hamming code			$\checkmark$		
13	*Configure static IP address in operating system along with appropriate subnet mask for given problem				$\checkmark$	
14	* Implement Classful Address in a given network node i)Identify range of IP Address in various classes ii)Justify the reason to choose various IP address classes for creating given network				~	
15	*Execute TCP/IP network commands: ipconfig, ping,tracert				$\checkmark$	
16	*Execute TCP/IP network commands: netstat, pathping, route				$\checkmark$	

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ta Coi	mmunication and Computer Network	 Course Code:	314318
17	*1) Install Wireshark and configure as packet sniffer- i)Capture IP,TELNET, FTP packets using Wireshark	✓	
18	Capture TCP and UDP packet using Wireshark	✓	
19	Capture ARP and ICMP packet Traffic using Wireshark	✓	
20	Install Operating System Linux/Windows/Any other Server	✓	
21	Use FTP protocol to transfer file from one system to another system	✓ ✓	
22	Create IPv6 environment in a small network using simulator	✓	
23	*Create HTTP server		~
24	*Create computers using Star topology with wired media		~
25	Create Tree topology using CISCO packet tracer software		~
26	Configure TELNET for remote login		~
27	*Visit your computer laboratory)Identify the type of topology ii)Identify types of connecting devices with specifications iii)Identify types of cables with specifications iv)List the type of network applications commonly used in the laboratory iv)Draw the layout of installed network		~
28	Share folder and printer in a network		

## **Guidelines to Teachers**

- 1. Teacher is expected to refer complete curriculum document and follow guidelines for implementation before start of curriculum.
- 2. At the beginning teacher should make the students acquainted with any of the given Simulation software environment as few practical are based on simulation.
- 3. Teacher should provide the guideline with demonstration of practical to the students with all features.
- 4. Teacher shall explain prior concepts to the students before starting of each practical
- 5. Involve students in performance of each practical.
- 6. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
- 7. Teachers should give opportunity to students for hands on experience after the demonstration.
- 8. Teacher is expected to share the skills and competencies to be developed in the students.
- 9. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected the students by the industry.

## **Instructions for Students**

- Listen carefully the lecture given by teacher about course, curriculum, learning structure, skills to be developed.
- 2. Before performing the practical student shall read lab manual of related practical to be conducted.
- 3. Organize the work in the group and make record of all observations.
- 4. Students shall develop maintenance skill as expected by industries.
- 5. Student shall attempt to develop related hand-on skills and gain confidence.
- 6. Student shall develop the habits of evolving more ideas, innovations, skills etc.
- 7. Student shall refer technical magazines, IS codes and data books.
- 8. Student should develop habit to submit the practical on date and time.
- 9. Student should well prepare while submitting write-up of exercise.

## **Content Page**

#### List of Practical and Formative Assessment Sheet

Sr.		Date of	Date of	Assessment	Teacher's	Dama
No	Practical Title	Performance	Submission	Marks (25)	Sign	Remark
1	* Amplitude Shift Keying(ASK) using any simulator					
2	Frequency Shift Keying(FSK) using any simulator					
3	Frequency Shift Keying(FSK) using any simulator					
4	*Create and Test standard straight network cable(Universal Colour Code) using crimping tool					
5	Create and Test standard Cross network cable(Universal Colour Code) using crimping tool					
6	* Generate a Time Division Multiplexing(TDM) signal using relevant simulation software					
7	*Create a Hybrid Network Using Bluetooth					
8	*Locate the error bit in the given data string by applying checksum error detection method					
9	*Implement Wireless network					
10	Write a 'C' program for parity check error detection					
11	*Write a 'C' program for Cyclic Redundancy Check(CRC) error detection					
12	*Write a 'C' program for error correction using Hamming code					
13	*Configure static IP address in operating system along with appropriate subnet mask for given problem					
14	* Implement Classful Address in a given network node i)Identify range of IP Address in various classes ii)Justify the reason to choose various IP address classes for creating given network					

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Data Communication and Computer Network

Jala C	Communication and Computer Network	-	C	Course Code: 3	14518
	*Execute TCP/IP network				
15	commands:ipconfig,				
	ping,tracert				
16	*Execute TCP/IP network				
10	commands: netstat, pathping, route				
	*Install Wireshark and configure as				
17	packet sniffer- i)Capture IP, TELNET,				
	FTP packets using Wireshark				
18	Capture TCP and UDP packet using				
10	Wireshark				
19	Capture ARP and ICMP packet				
17	Traffic using Wireshark				
20	Install Operating System				
	Linux/Windows/Any other Server				
21	Use FTP protocol to transfer file from				
	one system to another system				
22	Create IPv6 environment in a small				
	network using simulator				
23	*Create HTTP server				
	*Create commuters using Stor				
24	*Create computers using Star topology with wired media				
	Create Tree topology using CISCO				
25	packet tracer software				
	packet tracer software				
26	Configure TELNET for remote login				
	*Visit your computer				
	laboratoryi)Identify the type of				
	topology ii)Identify types of				
	connecting devices with				
	specifications iii)Identify types of				
27	cables				
	with specifications iv)List the type of				
	network applications commonly used				
	in the laboratory iv)Draw the layout				
	of installed network				
28	Share folder and printer in a network				
			T-4-1		
			Total		

#### \*Total marks to be transferred to proforma published by MSBTE

#### Note:

- '\*' Marked Practical's (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

## Practical No. 1: \*Amplitude Shift Keying (ASK) using any simulator

### I Practical Significance

Amplitude Shift Keying (ASK) is a type of Amplitude Modulation which represents the binary data in the form of variations in the amplitude of a signal. Any modulated signal has a high frequency carrier. The binary signal when ASK modulated, gives a zero value for Low input while it gives the carrier output for High input. This practical is designed to explain how change of amplitude in to level corresponds to logic 1 and logic 0.

## II Industry / Employer Expected Outcome(s)

- 1. To test the performance of Amplitude Shift Keying (ASK) using relevant simulation software.
- 2. To gain knowledge about Amplitude Shift Keying (ASK)

## III Course Level Learning Outcomes(s)

CO1 - Analyze the functioning of Data Communication and Computer Network

## IV Laboratory Learning Outcome(s)

LLO 1.1 Implement Amplitude Shift Keying (ASK)

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background

**Proposition 1:** Amplitude Shift Keying (ASK) is a digital modulation technique. It transmits the digital information by varying the amplitude of a carrier signal. In ASK, a high-amplitude carrier signal is used to represent a binary \_1,' and a low-amplitude carrier signal represents a binary \_0.'

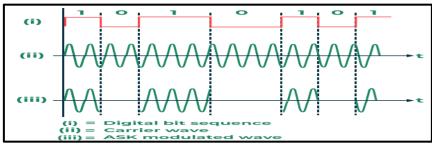
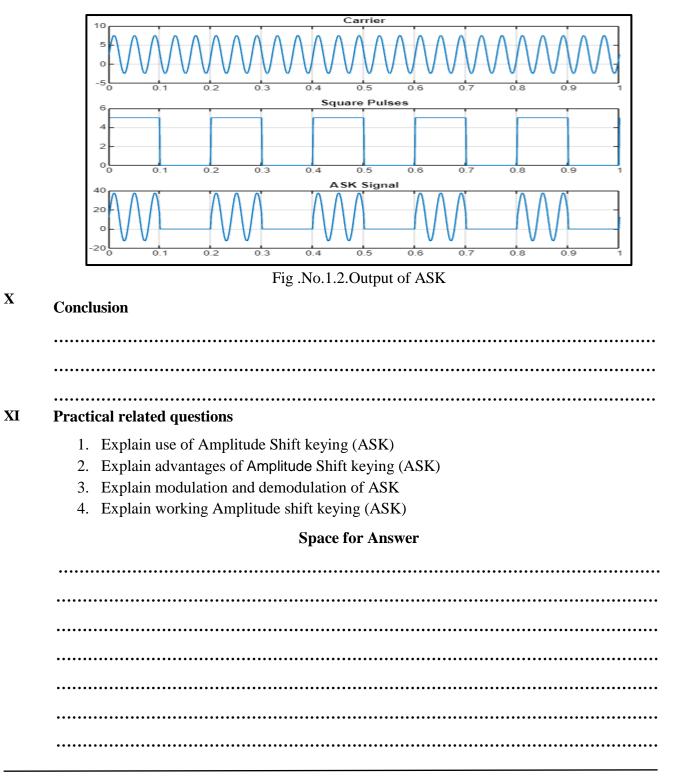


Fig.No.1.1. Amplitude Shift Keying (ASK)

VII	<ul> <li>Recourses Required:</li> <li>Desktop Computer</li> <li>Simulation Software (Lab vi Proteus or any other relevant</li> </ul>	ew/ MATLAB /SCILAB/P Spice /HS Spice / Multisim/ t open source software)				
VIII	Precautions to be followed:					
	<ol> <li>Handle equipment with care</li> <li>Follow safety Practices</li> </ol>					
IX	Procedure					
	<ol> <li>Open MATLAB</li> <li>Go to file and create a new (.m) fill</li> <li>Type the below code in the code of Use this link to install MATLAB set</li> </ol>	window.				
	https://in.mathworks.com/products/n	https://in.mathworks.com/products/matlab-online.html				
	Sample code for ASK using MAT clc; close all; clear all;					
	a=5; t=0:0.001:1;	% Amplitude				
	f1=input('carrier frequency:'); f2=input('pulse frequency:');	% for example 25 % for example 5				
	<pre>x=a.*sin(2*pi*f1*t)+(a/2); subplot(3,1,1); plot(t,x); title('Carrier'); grid on;</pre>	%carrier				
	u=a/2.*square(2*pi*f2*t)+(a/2); subplot(3,1,2); plot(t,u); title('Square Pulses'); grid on; v=x.*u; subplot(3,1,3); plot(t,v); title('ASK Signal'); grid on;	% Message signal				

- 4. Save the file.
- 5. Define the path directory.
- 6. Run the program using F5 key or run command.
- 7. Observe the output ASK signal in command window.



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#### XII References:

- 1. <u>Digital iVision Labs</u>!: <u>Amplitude Shift Keying (ASK) Modulation MATLAB</u> Simulation, With MATLAB Code (divilabs.com)</u>
- 2. Amplitude Shift Keying (tutorialspoint.com)
- 3. Amplitude Shift Keying GeeksforGeeks

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

## Practical No. 2: Frequency Shift Keying (FSK) using any simulator

#### I Practical Significance

**Frequency Shift Keying** (FSK) is the digital modulation technique in which the frequency of the carrier signal varies according to the digital signal changes. In this practical student are able to view shifts in frequency as per the input digital data by using simulation software.

## II Industry / Employer Expected Outcome(s)

1. Able to implement frequency Shift Keying using simulation software.

## III Course Level Learning Outcomes(s)

CO1 - Analyze the functioning of Data Communication and Computer Network

## IV Laboratory Learning Outcome(s)

LLO 2.1 Implement Frequency Shift Keying (FSK)

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background

#### ✤ Frequency Shift Keying (FSK)

In FSK, frequency of carrier signal is varied to represent the signal element. In FSK, one frequency represent binary 1 and other frequency represent binary 0. This is called as binary FSK. The frequency of modulated signal is constant for the duration of each bit and changes when bit changes. If FSK uses more than two frequencies then it is called as binary frequency.

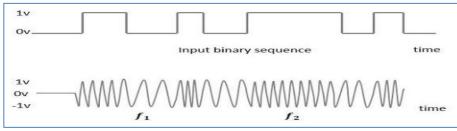
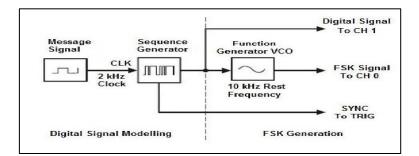


Fig.No.2.1. FSK Input-Output waveform





## VII Recourses Required:

- Computer / Networked Computers (with internet connectivity)
- Simulation Software (Lab view/ MATLAB /SCILAB/P Spice /HS Spice / Multisim/ Proteus or any other relevant open-source software)

## VIII Precautions to be followed:

- 1. Handle Computer system and peripherals with care.
- 2. Follow safety Practices

## IX Procedure

- 1. Open MATLAB
- 2. Go to file and create a new (.m) file.
- 3. Type the below code in the code window.

#### Use this link to install MATLAB software

https://in.mathworks.com/products/matlab-online.html

#### Sample code for FSK using MATLAB

clc; close all; clear all;

#### % Message signal input and ploting

n=[1 0 1 0];	% Message signal in binary form
N=length(n);	% Length of message signal
fs = 1000*N;	% Sampling frequency
t=0:1/fs:N;	% Time division with step b
N1=length(t);	% Length of total divisions
i=1;	
%Run for Loop	
for j=1:N1	
if t(j)<=i	

x(j)=n(i); else i=i+1; end end figure(1); subplot(3,2,1); plot(t,x,Linewidth',2); %Message signal plot title(Message signal'); xlabel(Time'); ylabel('Amplitude'); grid on %Carrier signals generation (x1,x2) a=2; %Amplitude scale for carrier signal f1=10; %1st carrier signal frequency f2=5; %2nd carrier signal frequency f2=5; %1st carrier signal frequency %Uncomment the following for user input x1=a*sin(2*pi*f1*t); %1st carrier signal subplot(3,2,2); plot(t,x1); %1st carrier signal plot title('1st carrier signal'); xlabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); %2nd carrier signal subplot(3,2,3); plot(t,x2); %2nd carrier signal plot title('2nd carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 yl(j)=x1(j); else yl(j)=x2(j); end end subplot(3,2,4);		
i=i+1; end end figure(1); subplot(3,2,1); plot(t,x,Linewidth',2); %Message signal plot title(Message signal'); xlabel(Time'); ylabel('Amplitude'); grid on $\begin{array}{c} & & & & & & & & & & & & & & & & & & &$	x(j)=n(i);	
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a=2; % Amplitude scale for carrier signal f1=10; % 1st carrier signal frequency f2=5; % 2nd carrier signal frequency % Uncomment the following for user input x1=a*sin(2*pi*f1*t); % 1st carrier signal subplot(3,2,2); plot(t,x1); % 1st carrier signal plot title('1st carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); % 2nd carrier signal subplot(3,2,3); plot(t,x2); % 2nd carrier signal plot title('2nd carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 y1(j)=x2(j); end end	title('Message signal'); xlabel('Time'); ylabel('Amplitude');	%Message signal plot
a=2; % Amplitude scale for carrier signal f1=10; % 1st carrier signal frequency f2=5; % 2nd carrier signal frequency % Uncomment the following for user input x1=a*sin(2*pi*f1*t); % 1st carrier signal subplot(3,2,2); plot(t,x1); % 1st carrier signal plot title('1st carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); % 2nd carrier signal subplot(3,2,3); plot(t,x2); % 2nd carrier signal plot title('2nd carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 y1(j)=x2(j); end end	%Carrier signals gene	eration (x1.x2)
f1=10; % 1st carrier signal frequency f2=5; % 2nd carrier signal frequency % Uncomment the following for user input x1=a*sin(2*pi*f1*t); % 1st carrier signal subplot(3,2,2); plot(t,x1); % 1st carrier signal plot title('1st carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); % 2nd carrier signal subplot(3,2,3); plot(t,x2); % 2nd carrier signal plot title('2nd carrier signal'); xlabel(Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 y1(j)=x1(j); else y1(j)=x2(j); end end	0 0	
f2=5; %2nd carrier signal frequency % Uncomment the following for user input x1=a*sin(2*pi*f1*t); %1st carrier signal subplot(3,2,2); plot(t,x1); %1st carrier signal plot title('1st carrier signal'); xlabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); %2nd carrier signal subplot(3,2,3); plot(t,x2); %2nd carrier signal plot title('2nd carrier signal'); xlabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 y1(j)=x2(j); end end		
x1=a*sin(2*pi*f1*t); % 1st carrier signal subplot(3,2,2); % 1st carrier signal plot title('1st carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); % 2nd carrier signal subplot(3,2,3); plot(t,x2); % 2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	f2=5;	%2nd carrier signal frequency
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subplot(3,2,2); plot(t,x1); %1st carrier signal plot title('1st carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t);%2nd carrier signal subplot(3,2,3); plot(t,x2);%2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	% Uncomment the follo	owing for user input
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title('1st carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); % 2nd carrier signal subplot(3,2,3); plot(t,x2); % 2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	subplot(3,2,2);	
xlabel('Time'); ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); %2nd carrier signal subplot(3,2,3); plot(t,x2); %2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 y1(j)=x1(j); else y1(j)=x2(j); end end	plot(t,x1);	%1st carrier signal plot
ylabel('Amplitude'); grid on x2=a*sin(2*pi*f2*t); %2nd carrier signal subplot(3,2,3); plot(t,x2); %2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	title('1st carrier signal');	
grid on x2=a*sin(2*pi*f2*t); %2nd carrier signal subplot(3,2,3); plot(t,x2); %2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if x(j)==1 y1(j)=x1(j); else y1(j)=x2(j); end end	<pre>xlabel('Time');</pre>	
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plot(t,x2); %2nd carrier signal plot title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	x2=a*sin(2*pi*f2*t);	%2nd carrier signal
title('2nd carrier signal'); xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	subplot(3,2,3);	
xlabel('Time'); ylabel('Amplitude'); grid on %Modulation section for $j=1:N1$ if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	plot(t,x2);	%2nd carrier signal plot
ylabel('Amplitude'); grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	title('2nd carrier signal')	;
grid on %Modulation section for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	<pre>xlabel('Time');</pre>	
%Modulation section for $j=1:N1$ if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	ylabel('Amplitude');	
for j=1:N1 if $x(j)==1$ y1(j)=x1(j); else y1(j)=x2(j); end end	grid on	
if x(j)==1 y1(j)=x1(j); else y1(j)=x2(j); end end	%Modulation section	
$y_1(j)=x_1(j);$ else $y_1(j)=x_2(j);$ end end	for j=1:N1	
else y1(j)=x2(j); end end	if $x(j) = 1$	
y1(j)=x2(j); end end	y1(j)=x1(j);	
end end	else	
end	y1(j)=x2(j);	
	end	
subplot(3.2.4);	end	
	subplot(3,2,4);	

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%Plot of FSK output signal

plot(t,y1); title('Modulated FSK output'); xlabel('Time'); ylabel('Amplitude'); grid on

- 4. Save the file.
- 5. Define the path directory.
- 6. Run the program using F5 key or run command.
- 7. Observe the output FSK signal in command window.

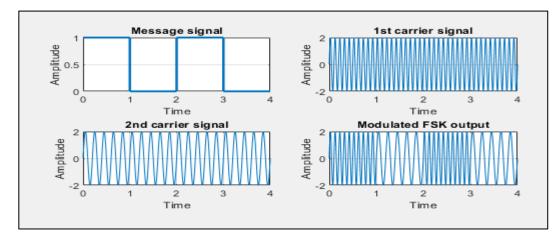


Fig.No.2.3. Output of FSK

## X Conclusion

#### XI Practical related questions

- 1. Write down applications of FSK.
- Write a MATLAB program to generate FSK waveform for the input (a) 1010110 (b) 1100101
- 3. Write the advantages of FSK.

#### **Space for Answer**

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#### XII References:

1.https://www.tutorialspoint.com/digital\_communication/digital\_communication\_frequency\_shi ft\_keying.htm 2. http://www.evelidete.in/leb2/pages/ESKS/ESK/ESK\_T.html

 $2.\ http://www.evalidate.in/lab2/pages/FSKS/FSK/FSK_T.html$ 

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# Practical No. 3: Phase Shift Keying (PSK) using any open-source simulation software

## I Practical Significance

Phase-shift keying (PSK) is a digital modulation process which conveys data by changing (modulating) the phase of a constant frequency carrier wave. The modulation is accomplished by varying the sine and cosine inputs at a precise time. In this practical student are able to view shifts in phase as per the input digital data by using simulation software.

## II Industry / Employer Expected Outcome(s)

- 1. To test the performance of Phase Shift Keying (PSK) using relevant simulation software.
- 2. To gain knowledge about Phase Shift Keying (PSK)

III Course Level Learning Outcomes(s)

CO1 - Analyze the functioning of Data Communication and Computer Network

## IV Laboratory Learning Outcome(s)

LLO 3.1 Implement Phase Shift Keying (PSK)

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background

**Proposition 1:** Phase Shift Keying PSK is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. It allows information in a more efficient way to be carried over a radio communications signal compare with other modulation forms. Data communication is rising with different forms of communication formats like analog to digital to carry data along with different modulation forms. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications

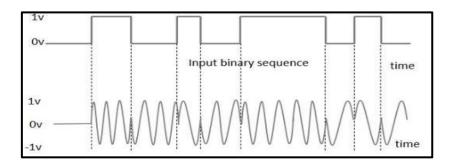


Fig. No.3.1. Phase shift keying

## VII Recourses Required:

- Computer / Networked Computers (with internet connectivity)
- Simulation Software (Lab view/ MATLAB /SCILAB/P Spice /HS Spice / Multisim/ Proteus or any other relevant open-source software)

## VIII Precautions to be followed:

- **1.** Handle equipment with care
- 2. Follow safety Practices

## IX Procedure:

- 1. Open MATLAB
- 2. Go to file and create a new (.m) file.

3. Type the below code in the code window.

#### Use this link to install MATLAB software

https://in.mathworks.com/products/matlab-online.html

#### Sample code for PSK using MATLAB

clc;	
close all;	
clear all;	
a=5;	% Amplitude
t=0:0.001:1;	
f1=input('carrier frequen	cy:'); % for example 20
f2=input('pulse frequenc	y:'); % for example 5
x=a.*sin(2*pi*f1*t);	%carrier
subplot $(3,1,1);$	/ocallici
1 ( ) / / / /	
plot(t,x);	
title('Carrier');	
grid on;	

u=square(2*pi*f2*t)	% Message signal
subplot(3,1,2);	
plot(t,u);	
title('Square Pulses');	
grid on;	
v=x.*u;	
subplot(3,1,3);	
plot(t,v);	
title('PSK Signal');	
grid on;	

- 4. Save the file.
- 5. Define the path directory.
- 6. Run the program using F5 key or run command.
- 7. Observe the output PSK signal in command window.

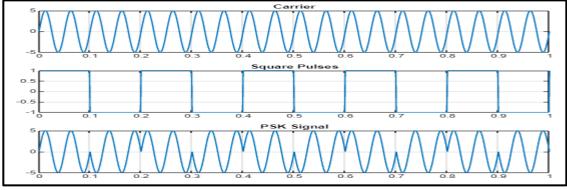


Fig.No.3.2. Output of PSK

## X Conclusion

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#### XI Practical related questions

- 1. Explain use of Phase Shift keying (PSK)
- 2. Explain advantages of Phase Shift keying(PSK)
- 3. Explain modulation and demodulation of PSK
- 4. Explain Difference between ASK, FSK, PSK

#### **Space for Answer**

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#### XII References:

- 1. Phase Shift Keying : Types, Forms, and Its Applications (watelectronics.com)
- 2. Digital Communication Phase Shift Keying (tutorialspoint.com)

## XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# **Practical No. 4:** \*Create and Test standard straight network cable (Universal Colour Code) using crimping tool

## I Practical Significance

Student should be able to create and test standard straight network cable using crimping tool

## II Industry / Employer Expected Outcome(s)

- 1. To identify different network cable.
- 2. To Prepare straight and crossover network cable.
- 3. To test network cable

## **III** Course Level Learning Outcomes(s)

CO2 - Select relevant Transmission Media and Switching Techniques as per need

## IV Laboratory Learning Outcome(s)

LLO 4.1 Create standard network straight cable by using cable tester

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background Straight network cable

Straight-through cables will be used to connect different of hosts to each other. This means that whenever you are connecting a computer to a router, a router to a switch, and so on, you will have to use a straight-through cable for the hosts to communicate with each other.



Fig.No.4.1. Colour Code on Both Side

#### Proposition 2: RJ45 Connector and Crimper

- **1.** RJ45 stands for Registered Jack 45 and is the most commonly used connector in wired networks. The jacks are mainly used to connect to the Local Area Network
- **2.** RJ45 has a transparent plastic structure and is an 8-pin connector. It is an 8P8C connector and the number of wires that can be connected is 8. The jacks are mostly used with Shielded Twisted Pair cables or Unshielded Twisted Pair cables.
- 3. A crimping tool is designed to crimp or connect a connector to the end of cable
- 4. Network cables and phone cables are created using a crimping tool to connect the RJ-45 connectors to the end of the cable.

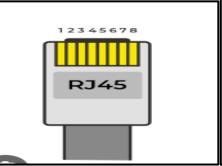


Fig. No. 4.2. RJ 45 Connector



Fig. No. 4.3. Crimping Tool

## VII Recourses Required:

- 1. UTP/STP cable.
- 2. Connector (Mainly RJ45 connector)
- 3. Networks toolkit (Mainly Crimping tool.)
- 4. Line tester or cable tester.
- 5. Computer and Network control devices.

## VIII Precautions to be followed:

1. Handle carefully Crimping Tool and network devices.

2. Follow safety Practices

## IX Procedure: Prepare straight cable

**1.** Cut into the plastic sheath 1 inch from the end of cut cable. The crimping tool has a razor blade that will do the trick



Fig. No. 4.4 .Cut cable plastic cover

2. Unwind it and pair of the similar colors



Fig. No. 4.5. Separate pair wires 3. After that straighten them out. Pinch the wires between your fingers

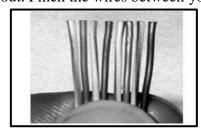


Fig. No. 4.6. Straighten Wire

4. Use scissors to make a straight cut across the wires 1/2 Inch from the cut sleeve to the end of. Push the wire into connector



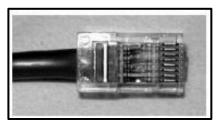
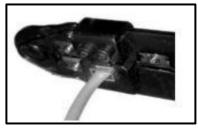
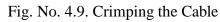


Fig. No.4.7. Fit cable in to Connector

Fig. No. 4.8. Top view of Connector

5. Crimping the Cable: carefully place the connector into the Ethernet Crimper and cinch down on the handles tightly. The copper splicing tabs on the connector will pierce into each of the eight wires. There is also a locking tab that holds the blue plastic sleeve in place for a tight compression fit. When you remove the cable from the crimper, the cable is ready to use.





6. Repeat all steps on the other end of the Ethernet cable exactly.

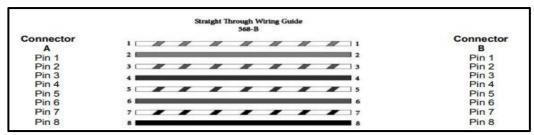


Fig. No. 4.10. Pin Format on both Side

7. Make sure to test the cables using line tester before installing them. An inexpensive Ethernet cable tester does this quite well.



Fig. No.4.11. Cable or line Tester

### X Conclusion

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#### XI XII. Practical related questions

- 1. Which tool is used to test network cable?
- 2. Explain Use of Cable in networking
- 3. Explain types of Transmission medium
- 4. State the purpose to use RJ45 connector.
- 5. Give the names of RJ45 pinout for each pin along with pin number.

#### **Space for Answer**

#### XII References:

- 1. <u>https://gesrepair.com/wire-crimping-process/</u>
- 2. <u>https://www.wikihow.com/Crimp-Rj45</u>
- 3. https://jemelectronics.com/cable-crimping-methods-101/

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

#### Practical No. 5: Create and Test standard Cross network cable (Universal Colour Code) using crimping tool

### I Practical Significance

Student should be able to create and test standard cross network cable using crimping tool

### II Industry / Employer Expected Outcome(s) To identify different network cable.

- 1. To Prepare straight and crossover network cable.
- 2. To test network cable

### III Course Level Learning Outcomes(s)

CO2 - Select relevant Transmission Media and Switching Techniques as per need

### IV Laboratory Learning Outcome(s)

LLO 5.1 Create standard network Cross cable by using cable tester

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

### VI Relevant Theoretical Background

#### Cross network cable

Cross network cable It is used to connect two devices of the same type: two computers or two switches to each other. Both sides (side A and side B) of cable have wire arrangement with different color

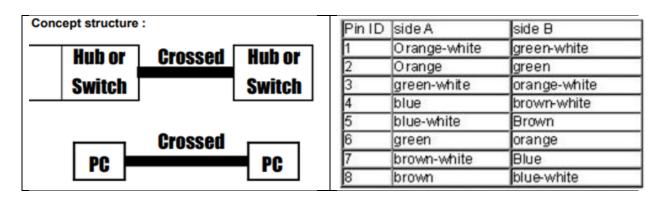


Fig.No.5.1. Colour Code on Both Side

#### ✤ RJ45 Connector and Crimper

- **1.** RJ45 stands for Registered Jack 45 and is the most commonly used connector in wired networks. The jacks are mainly used to connect to the Local Area Network
- **2.** RJ45 has a transparent plastic structure and is an 8-pin connector. It is an 8P8C connector and the number of wires that can be connected is 8. The jacks are mostly used with Shielded Twisted Pair cables or Unshielded Twisted Pair cables.
- 3. A crimping tool is designed to crimp or connect a connector to the end of cable
- **4.** Network cables and phone cables are created using a crimping tool to connect the RJ-45 connectors to the end of the cable.

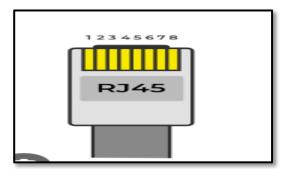


Fig .No. 5.2 .RJ 45 Connector

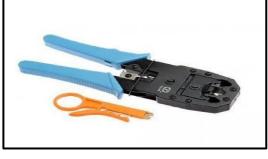


Fig. No.5.3.Crimping Tool

### VII Recourses Required:

- 1. UTP/STP cable.
- 2. Connector (Mainly RJ45 connector)
- 3. Networks toolkit (Mainly Crimping tool.)
- 4. Line tester or cable tester.
- 5. Computer and Network control devices.

### VIII Precautions to be followed:

1. Handle carefully Crimping Tool and network devices.

2. Follow safety Practices

### IX Procedure: Prepare Cross Cable.

1. Cut into the plastic sheath 1 inch from the end of cut cable. The crimping tool has a razor blade that will do the trick



Fig. No.5.4. Cut cable plastic cover

2. Unwind it and pair of the similar colors



Fig. No.5.5. Separate pair wires

3. After that straighten them out. Pinch the wires between your fingers

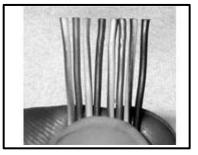


Fig. No. 5.6. Straighten Wire

4. Use scissors to make a straight cut across the wires 1/2 Inch from the cut sleeve to the end of. Push the wire into connector



Fig.No.5.7. Fit cable in to Connector



Fig .No. 5.8 .Top view of Connector

5. Crimping the Cable: carefully place the connector into the Ethernet Crimper and cinch down on the handles tightly. The copper splicing tabs on the connector will pierce into each of the eight wires. there is also a locking tab that holds the blue plastic sleeve in place for a tight compression fit. When you remove the cable from the crimper, the cable is ready to use.

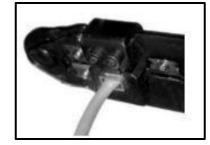


Fig.No.5.9. Crimping the Cable

6. Repeat all steps on the other end of the Ethernet cable exactly.

Connector A		1	Connector B
Pin 1 Pin 2	3	3	Pin 3 Pin 6
Pin 3 Pin 4	4	4	Pin 1 Pin 7
Pin 5	5	5	Pin 8
Pin 6	6	6	Pin 2
Pin 7		7	Pin 4
Pin 8		8	Pin 5

Fig.No.5.10. Pin Format on both Side

7. Make sure to test the cables using line tester before installing them. An inexpensive Ethernet cable tester does this quite well.



Fig. No. 5.11. Cable or Line Tester

### X Conclusion

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#### **XI** Practical related questions

- 1. What is a use of crossover network cable?
- 2. Explain uses of transmission medium
- 3. State the use of connector and give the name of connector used in laboratory
- 4. Explain Difference Between straight and cross cable.
- 5. What is the meaning of RJ?

#### **Space for Answer**

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- 2. https://www.wikihow.com/Crimp-Rj45
- 3. How To Make An Ethernet Cross-Over Cable (makeuseof.com)

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# **Practical No. 6:** \*Generate a Time Division Multiplexing (TDM) signal using relevant simulation software

### I Practical Significance

Time division multiplexing (TDM) is a communication process that transmits two or more streaming digital signals over a common channel. In TDM, incoming signals are divided into equal fixed-length time slots. After multiplexing, these signals are transmitted over a shared medium and reassembled into their original format after demultiplexing. Time slot selection is directly proportional to overall system efficiency. In this practical, students will generate TDM signal and reconstruct it using simulation software

### II Industry / Employer Expected Outcome(s)

- 1. Able to use basic programming skills to simulate communication system.
- 2. Able to Generate a TDM signal using relevant simulation software.

### III Course Level Learning Outcomes(s)

CO2 - Select relevant Transmission Media and Switching Techniques as per need.

### IV Laboratory Learning Outcome(s)

LLO 6.1 Use basic programming skills to simulate communication systems. LLO 6.2 Debug and execute the program for Time Division Multiplexing (TDM)

#### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

### VI Relevant Theoretical Background

#### **\*** TDM (Time Division Multiplexing)

Time-division multiplexing is a multiplexing technique that is used to transmit two or more streaming digital signals above a common channel. In this type of multiplexing technique, incoming signals are separated into equivalent fixed-length time slots. Once multiplexing is done, these signals are sent over a shared medium & after de-multiplexing, they are reassembled into their original format.

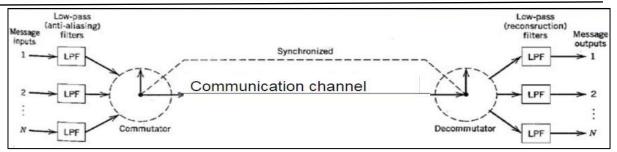


Fig.No.6.1.TDM block diagram

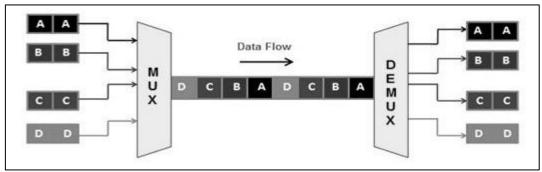


Fig.No.6.2.TDM

### VII Recourses Required:

- Computer / Networked Computers
- Simulation Software(Lab view/ MATLAB /SCILAB/P Spice /HS Spice / Multisim/ Proteus or any other relevant open source software)

### VIII Precautions to be followed:

- 1. Handle Computer system and peripherals with care.
- 2. Follow safety Practices

### IX Procedure

- 1. Open MATLAB
- 2. Go to file and create a new (.m) file.
- 3. Type the below code in the code window.

#### Use this link to install MATLAB software

https://in.mathworks.com/products/matlab-online.html

#### Sample code for TDM signal Generation using MATLAB -code

clc; close all; clear all; % Signal generation

x=0:.5:4*pi;	% signal taken upto 4pi
<pre>sig1=8*sin(x);</pre>	% generate 1 <sup>st</sup> sinusoidal signal
l=length(sig1);	
sig2=8*triang(l);	% Generate 2 <sup>nd</sup> triangular Signal

#### % Display of Both Signal

subplot(2,2,1);
plot(sig1);
title('Sinusoidal Signal');
ylabel('Amplitude--->');
xlabel('Time--->');

subplot(2,2,2);
plot(sig2);

title('Triangular Signal'); ylabel('Amplitude--->'); xlabel('Time--->');

#### % Display of Both Sampled Signal

subplot(2,2,3); stem(sig1); title('Sampled Sinusoidal Signal'); ylabel('Amplitude--->'); xlabel('Time--->'); subplot(2,2,4); stem(sig2); title('Sampled Triangular Signal'); ylabel('Amplitude--->'); xlabel('Time--->');

11=length(sig1); 12=length(sig2); for i=1:l1 sig(1,i)=sig1(i); % Making Both row vector to a matrix sig(2,i)=sig2(i); end

## % **TDM of both quantize signal** tdmsig=reshape(sig,1,2\*11);

#### % Display of TDM Signal figure

stem(tdmsig); title('TDM Signal'); ylabel('Amplitude--->'); xlabel('Time--->'); % Demultiplexing of TDM Signal

demux=reshape(tdmsig,2,11);
for i=1:11
sig3(i)=demux(1,i); % Converting The matrix into row vectors
sig4(i)=demux(2,i);
end

- 4. Save the file.
- 5. Define the path directory.
- 6. Run the program using F5 key or run command.
- 7. Observe the output TDM signal in command window.
- 8. Paste the print out under observations heading.

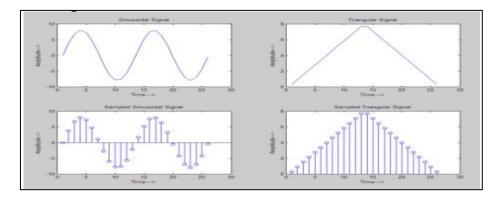


Fig.No.6.3. Sinusoidal and Triangular Signal

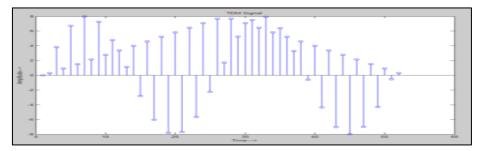


Fig.No.6.4. TDM Signal

### X Conclusion

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#### XI Practical related questions

- 1. Write down applications of TDM.
- 2. Why TDM more suitable for digital signal transmission.
- 3. State the function of commutator and decommutator switches.

#### Space for Answer

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2. https://www.geeksforgeeks.org/frequency-division-and-time-division-multiplexing/

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

#### Practical No. 7: \*Create a Hybrid Network Using Bluetooth

#### I Practical Significance

Bluetooth is used for short-range wireless voice and data communication. It is a Wireless Personal Area Network (WPAN) technology and is used for data communications over smaller distances. A Bluetooth network is called a piconet and a group of interconnected piconets is called a scatternet. Student should be able to create a Hybrid Network using Bluetooth.

### II Industry / Employer Expected Outcome(s)

- 1. Identify Bluetooth enabled devices
- 2. Create Hybrid network using Bluetooth

III Course Level Learning Outcomes(s)

CO3 - Analyze the Transmission Errors with respect to IEEE standards.

### IV Laboratory Learning Outcome(s)

LLO 7.1 Transfer data using Bluetooth

#### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

#### VI Relevant Theoretical Background

#### Piconet

A piconet is the type of connection that is formed between two or more Bluetooth-enabled devices such as modern cell phones or PDAs over a short range of 10m radius. Network ranges from two to eight connected devices. When network is established, one device takes the role of the master while all other devices act as slaves. The master node is the primary station that manages the small network. The slave stations are secondary stations that are synchronized with the primary station. Communication can take place between a master node and a slave node in either one-to-one or one-to-many manner. However, no direct communication takes place between slaves

#### ✤ Scatternet

A scatternet is a number of interconnected piconets that supports communication between more than 8 devices. Scatternets can be formed when a member of one piconet (either the master or one of the slaves) elects to participate as a slave in a second, separate piconet. The device participating in both piconets can relay data between members of both ad hoc networks. However, the basic Bluetooth protocol does not support this relaying - the host software of each device would need to manage it. Using this approach, it is possible to join together numerous piconets into a large scatternet, and to expand the physical size of the network beyond Bluetooth's limited range.

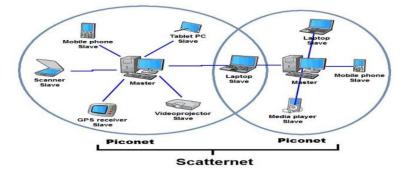


Fig.No. 7.1. Piconet and scatternet

### VII Recourses Required:

- Bluetooth enabled Mobile Phone
- Bluetooth enabled Laptop/Tablet/PC

### VIII Precautions to be followed:

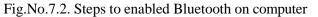
- 1. Handle equipment with care
- **2.** Follow safety Practices

### IX Procedure

#### Steps to Create a Hybrid Network Using Bluetooth

- 1. First ensure Bluetooth is enabled on the device you want to pair with your computer.
- 2. Next ensure Bluetooth is enabled on your computer.
  - On Windows 10, visit **Settings > Devices > Bluetooth & other devices**. If the **Bluetooth** slider at the top is off, turn it on. Then choose **Add Bluetooth or other device**, followed by the **Bluetooth** type.

Settings	
ය Home	Bluetooth & other devices
Find a setting $ ho$ Devices	+ Add Bluetooth or other device
	Bluetooth
Bluetooth & other devices	On On
品 Printers & scanners	Now discoverable as "BEN-DESKTOP"
() Mouse	Mouse, keyboard, & pen
📟 Typing	Gaming Mouse G502



#### **3 Bluetooth Pairing**

During the pairing process, follow any instructions that appear on your PC or phone. In some cases, you'll have to type or confirm a passcode. If you don't see a code appear on either device, it's probably a generic number like **1234** or **0000**. Once you confirm this code, your phone should connect to your PC and will automatically do so in the future, as long as the devices are in range.

If you can't get the devices to find each other, one of them is likely not discoverable. As a security feature, most Bluetooth devices only broadcast themselves when you have their Bluetooth options open.

The connection will remain active until you turn off Bluetooth, manually disconnect the devices, turn one of them off, or move them out of range.

#### 4.Transfer Files Between a Phone and PC Using Bluetooth

Once you've paired your phone and computer wirelessly, the actual Bluetooth file transfer process is pretty simple. Sharing from your phone to a PC is most generally available on Android, since iOS devices use AirDrop for this.

To transfer from your phone, all you need to do is select a file in whatever app you're using, and choose the option to share it. The exact method depends on the app, but most have a universal **Share** icon to look for.

When you see the list of methods you can share through, look for the **Bluetooth** entry. Then select your PC as the destination device. Windows will then request confirmation and start downloading the file. You may be allowed to choose the save location, or it might save to a standard **Downloads** folder.

When transferring a file from your PC to your phone, simply open File Explorer and right-click on the file you want to transfer. Select **Send to > Bluetooth device**.

Open		Bluetooth File Transfer	×
Convert image file Create slideshow Set as desktop background Edit Print		Select where to send your files           Ben's Pixel 3         WH-1000XM3	
Share with Skype  Share  Share  Share  Share  Combine files with Nitro  Open with  Open with  Share with Resilio Sync  Give access to  Share with Maiwarebytes  Share with Maiwarebytes	Bluetooth device  Compressed (zipped) folder  Desktop (create shortcut)  Documents  Compressed (zipped) folder  Parsecipient  Mail recipient  ShareX  ShareX  ShareX	Phone Bluetooth headset	
Restore previous versions Send to	A DVD RW Drive (F:) MPOW-USB (G:)	Use authentication to ensure that you are sending the file to the correct device. The authentication also protects the file from being viewed by others while it is sent to the other device.  Use authentication Next Cancel	el

Fig. No. 7.3. Transferring a file from PC to mobile using Bluetooth

This will open a new window where you can select the device to send the file to. Your phone may ask for your approval. Once you confirm, the file will transfer over Bluetooth. You can transfer multiple files in either direction. Just select them all at once and follow the above steps.

X	Conclusion
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XI	Practical related questions
	1. What is Wireless Network?
	2. What is Piconet?
	3. What is scatternet?
	4. What is the range of Piconet?
	Space for Answer
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 $2.\ https://www.makeuseof.com/tag/how-to-connect-your-cell-phone-to-your-pc-through-bluetooth/$ 

3. https://www.tutorialspoint.com/what-is-piconet

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Dated Signature of Course Teacher	

**Practical No. 8:** \*Locate the error bit in the given data string by applying checksum error detection method

#### I Practical Significance

Error is a condition when the receiver's information does not match with the sender's information. During transmission, digital signals suffer from noise that can introduce errors in the binary bits travelling from sender to receiver. That means a 0 bit may change to 1 or a 1 bit may change to 0. To avoid this, error-detecting codes are used which are additional data added to a given digital message to detect any error that has occurred during transmission of the message. The student will be able to detect errors in a given data stream by using checksum error detection method.

### II Industry / Employer Expected Outcome(s)

- 1. Locate error bit in the given data stream
- 2. To gain knowledge about checksum error detection method

#### III Course Level Learning Outcomes(s)

CO3 - Analyze the Transmission Errors with respect to IEEE standards.

### IV Laboratory Learning Outcome(s)

LLO 8.1 Identify different error detection methods. LLO 8.2 Detect errors using Checksum

#### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

#### VI Relevant Theoretical Background

**Error** is a condition when the receiver's information does not match the sender's information.

**Types of error** 

1. Single-Bit Error

2. Burst Error

**1. Single-Bit Error:** The only one bit of a given data unit is changed from 1 to 0 or from 0 to 1

**2** Burst Error: The two or more bits are changed from 0 to 1 or from 1 to 0 is known as Burst Error. Whenever a message is transmitted, it may get scrambled by noise and the data may get corrupted. Basic approach used for error detection is the use of redundancy bits, where additional bits are added to facilitate detection of errors.

#### Some of the techniques for error detection are:

- 1. Parity check
- 2. Two-dimensional Parity check
- 3. Checksum
- 4. Cyclic redundancy check

#### ✤ Checksum

In checksum error detection scheme, the data is divided into k segments each of m bits. In the sender's end the segments are added using 1's complement arithmetic to get the sum. The sum is complemented to get the checksum. The checksum segment is sent along with the data segments.

At the receiver's end, all received segments are added using 1's complement arithmetic to get the sum. The sum is complemented. If the result is zero, the received data is accepted; otherwise, the received data is discarded.

### VII Recourses Required:

Computer/Network Computer

#### VIII Precautions to be followed:

- **1.** Handle equipment with care
- 2. Follow safety Practices

#### Procedure

IX

#### Example

# Suppose that the sender wants to send 4 frames each of 8 bits, where the frames are 10011001 11100010 00100100 10000100.

The sender adds the bits using 1s complement arithmetic. While adding two numbers using 1s complement arithmetic, if there is a carry over, it is added to the sum.

After adding all the 4 frames, the sender complements the sum to get the checksum 11011010, and sends it along with the data frames.

#### Data transmitted to Receiver is -

10011001	11100010	00100100	10000100	11011010
Data				Checksum

The receiver performs 1s complement arithmetic sum of all the frames including the checksum. The result is complemented and found to be 0. Hence, the receiver assumes that no error has occurred.

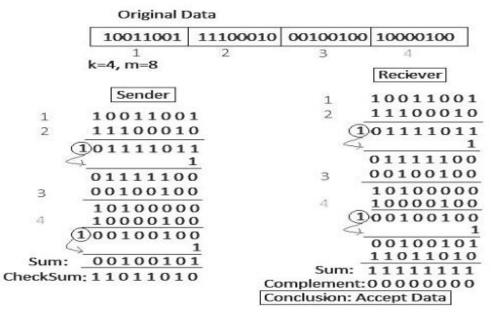


Fig.No.8.1. Example of checksum error detection method

### X Conclusion

#### **XI Practical related questions**

- 1. Define error. List types of error
- 2. List types of error detection techniques.
- 3. For the bit sequence 10101001 00111001, determine the checksum
- 4. For the bit sequence 110101, 101010, 100100, 111100, determine the checksum

#### Space for Answer

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- 1. https://www.geeksforgeeks.org/error-detection-code-checksum/
- 2. https://www.tutorialspoint.com/error-detecting-codes-checksums
- 3. https://www.youtube.com/watch?v=aNqiTCZ-nko

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 9: \*Implement Wireless Network

### I Practical Significance

Student should be able to study settings of wireless network.

### II Industry / Employer Expected Outcome(s)

- 1. Understand basic of TCP/IP utilities.
- 2. Understand networking commands
- III Course Level Learning Outcomes(s)

CO3 - Analyze the Transmission Errors with respect to IEEE standards.

IV Laboratory Learning Outcome(s)

LLO 9.1 create WI-FI environment.

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

#### **Relevant Theoretical Background**

#### Wireless Network

VI

A wireless network refers to a computer network that makes use of Radio Frequency (RF) connections between nodes in the network. A wireless network keeps devices connected to a network while still allowing them the freedom to move about, unencumbered by wires. A wireless network is a computer network that uses wireless data connections between network nodes.

Wireless networking is a method by which homes, telecommunications networks and business installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Wireless telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure. Examples of wireless networks include cell phone networks, wireless local area networks (WLANs), wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

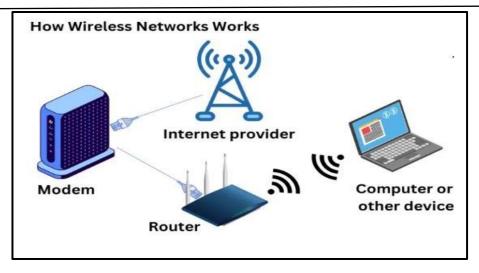


Fig. No. 9.1. Wireless Network

#### ✤ Wireless Router

A wireless router or Wi-Fi router is a device that performs the functions of a router and also includes the functions of a wireless access point. It is used to provide access to the Internet or a private computer network. Depending on the manufacturer and model, it can function in a wired local area network, in a wireless-only LAN, or in a mixed wired and wireless network.



Fig. No. 9.2. Wireless Router

#### Wireless Network Adapter

A wireless adapter is a hardware device that is generally attached to a computer or other workstation device to allow it to connect to a wireless system. Before the advent of consumer devices with built-in Wi-Fi connectivity, devices required the use of wireless adapters to connect to a network.



Fig. No. 9.3. Wireless Network Adapter

### VII Recourses Required:

- 1. Computer / Networked Computer
- 2. Router
- 3. Network Cable
- 4. RJ 45 Connector

### **VIII** Precautions to be followed:

1. Handle Computer system carefully

2. Follow safety Practices

### IX Procedure: Implementation of wireless Network

Follow the instructions below to setup your wireless network.

1. Find the best location for your wireless router.

2. Turn off the modem. Power off the cable or DSL modem from your ISP before connecting your equipment.

3. Connect the router to the modem. Plug an Ethernet cable into the router's WAN port and then the other end to the modem.

4. Connect your laptop or computer to the router. Plug one end of another Ethernet cable into the router's LAN port and the other end into your laptop's Ethernet port.

5. Power up the modem, router, and computer in turn.

6. Go to the management web page for your router. Open a browser and type in the IP address of the router's administration page.

7. Change the default administrator user name and password for your router. This setting is usually found in a tab or section called administration. Remember to use a strong password that you won't forget.

8. Add WPA2 security. This step is essential. You can find this setting in the wireless security section, where you'll select which type of encryption to use and then enter a passphrase of at least 8 characters—the more characters and the more complex the password, the better.

9. Change the wireless network name (SSID). To make it easy for you to identify your network, choose a descriptive name for your SSID (Service Set Identifier) in the wireless network information section.

10. Change the wireless channel. If you're in an area with a lot of other wireless networks, you can minimize interference by changing your router's wireless channel to one less used by other networks. You can use a WiFi analyzer app for your smartphone to find the least crowded channel or just use trial and error (try channels 1, 6, or 11, since they don't overlap).

11. Set up the wireless adapter on the computer. After saving the configuration settings on the router above, you can unplug the cable connecting your computer to the router. Then plug your USB or PC card wireless adapter into your laptop, if it doesn't already have a wireless adapter installed or built-in. Your computer may automatically install the drivers or you may have to use the setup CD that came with the adapter to install it.

12. Finally, connect to your new wireless network. On your computer and other wirelessenabled devices, find the new network you set up and connect to it.

#### Х Conclusion

XI

..... \_\_\_\_\_ ..... **Practical related questions** 1. Write Difference between wire and Wireless Network 2. Explain use of Wireless Router 3. Explain Concept of WPAN 4. Explain advantages of Wireless Network. **Space for Answer** ..... ..... 

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- 1. <u>How to Set up Wireless Network? (linkedin.com)</u>
- 2. AWS ping
- 3. <u>ML | Amazon Web Services (youtube.com)</u>

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

## Practical No. 10: Write a C Program for Parity check error detection

## I Practical Significance

Parity check is a simple error detection method that involves adding an extra bit to a data transmission. Student should be able to write a C program for parity check error detection.

# II Industry / Employer Expected Outcome(s)

- 1. To write a C program for parity check error detection
- 2. To gain knowledge about parity check error detection method

## III Course Level Learning Outcomes(s)

CO3 - Analyze the Transmission Errors with respect to IEEE standards.

## IV Laboratory Learning Outcome(s)

LLO 10.1 Draw block diagram for parity check.

LLO 10.2 Implement parity check with examples.

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

#### \* Parity Check

In Parity Check, a parity bit is an extra bit included in binary message to make total number of 1's either odd or even. Parity word denotes number of 1's in a binary string. There are two parity systems – even and odd parity checks.

- 1. Even Parity Check: Total number of 1's in the given data bit should be even. So, if the total number of 1's in the data bit is odd then a single 1 will be appended to make total number of 1's even else 0 will be appended
- 2. Odd Parity Check: In odd parity system, if the total number of 1's in the given binary string (or data bits) are even then 1 is appended to make the total count of 1's as odd else 0 is appended.

# VII Recourses Required:

- Computer/Network Computer
- Turbo C.

## IX Procedure

## Example

For example, consider a message string 100011 that needs to be transmitted. Let us assume the even parity scheme. The following will now happen.

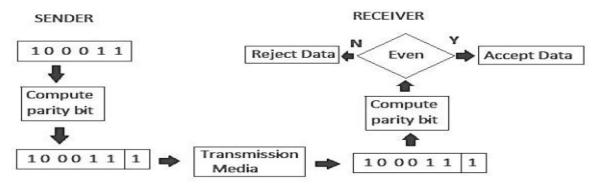
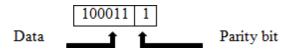


Fig. No.10.1. Parity Check Error Detection technique

**1.** The sender examines this message string and notes that the number of bits containing a value 1 in this message string is 3. Therefore, it adds an extra 1 to the end of this message. This extra bit is called parity bit.

**2.** The sender sends the original bits 100011 and the additional parity bit 1 together to the receiver



**3.** The receiver separates the parity bit from the original bits and it also examines the original bits. It sees the original bits as 100011, and notes that the number of 1s in the message is three i.e. odd.

**4.** The receiver now computes the parity bit again and compares this computed parity bit with the 1 parity bit received from the sender, it notes that are equal and accepts the bit string as correct.

# X Conclusion

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## XI Practical related questions

- 1. What is Even and Odd Parity check?
- 2. Write a C program for Parity Check error detection method.
- 3. For 1011000 data, find out codeword that send to receiver by using Parity check detection method.

#### **Space for Answer**

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- 1. https://www.geeksforgeeks.org/error-detection-codes-parity-bit-method/
- 2. https://www.youtube.com/watch?v=aNqiTCZ-nko
- 3. https://www.javatpoint.com/computer-network-error-detection

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

**Practical No. 11:** \*Write a C program for Cyclic Redundancy Check (CRC) error detection

#### **Practical Significance**

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VI

Student should be able to write a C program for error detection.

## II Industry / Employer Expected Outcome(s)

- 1. To write a C program for CRC error detection.
- 2. To gain knowledge about CRC

# III Course Level Learning Outcomes(s)

CO3 - Analyze the Transmission Errors with respect to IEEE standards.

## IV Laboratory Learning Outcome(s)

LLO 11.1 Implement C Program for CRC

# V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## **Relevant Theoretical Background**

## Cyclic Redundancy Check (CRC)

When data is transmitted from one device to another device, the system does not guarantee whether the data received by the device is identical to the data transmitted by another device. An Error is a situation when the message received at the receiver end is not identical to the message transmitted it is called error detection. A cycle redundancy check (CRC) in C programming is an error detecting technique commonly used in storage devices, etc. Block of data is entered and is checked and it is based on if the remainder is 0 or not and if it is not found to be zero then an error is detected in the code. CRCs are popular because they are simple to implement in binary hardware. CRCs basically are used as xor operation is performed between two numbers if remainder is zero then no error if it's not zero then error is detected.

## Example of Cyclic Redundancy Check (CRC)

Dividend / Data word: 100100 Divisor :1101

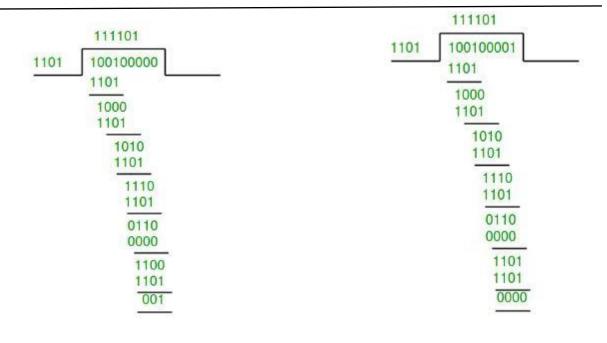


Fig. No.11.1. Sender Side

Fig.No.11.2. Receiver side

Sender side remainder is 001 which is encoded with data word 100100001. Code word received at receiver side 100100001. And divisor is same 1101. After performing division, the remainder is all 0000 hence, the data received has no Error.

# VII Recourses Required: Computer / Networked Computer Turbo C. VIII Precautions to be followed: Handle Computer system carefully Follow safety Practices IX Procedure: Write a C program for Cyclic Redundancy check error detection for dividend 10111011 and divisor 1001. And check output that is error is present or not. X Conclusion

XI	Practical related questions
	1. What is CRC?
	2. Define Error Detection
	3. Explain types of Error Detection methods
	4. How to check error with CRC.
	Space for Answer
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#### XII References:

- 1. Computer Network | Error Detection javatpoint
- 2. Cyclic Redundancy Code (CRC) in C Naukri Code 360
- 3. <u>CRC Program in C Scaler Topics</u>

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

## Practical No. 12: \*Write a C program for error correction using Hamming code

## I Practical Significance

Hamming code is an error correction system that can detect and correct errors when data is stored or transmitted. It requires adding additional parity bits with the data. Student should be able to write a C program for error correction using hamming code

# II Industry / Employer Expected Outcome(s)

- 1. To write a C program for error correction using hamming code
- 2. To gain knowledge about Hamming Code error correction method

## III Course Level Learning Outcomes(s)

CO3 - Analyze the Transmission Errors with respect to IEEE standards.

# IV Laboratory Learning Outcome(s)

LLO 12.1 Implement Hamming code in any suitable programming language

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

Error Correction

Once the errors are detected in the network, the deviated bits sequence needs to be replaced with the right bit sequence so that the receiver can accept the data and process it. This method is called Error Correction. We can correct the errors in the Network in two different ways which are Forward Error Correction: In this Error Correction Scenario, the receiving end is responsible for correcting the network error. There is no need for retransmission of the data from the sender's side. Backward Error Correction: Backward Error Correction means that the receiver needs to correct the error either by transmitting the corrupted message or retransmitting the entire message to the destination.

## Proposition 2: Hamming Code

In this method, extra parity bits are appended to the message which are used by the receiver to correct the single bit error and multiple bit error. Consider the below example to understand this method in a better way.

## Example:

Construct the even parity Hamming code word for a data byte 1001101. The number (1001101) of bits is 7.

## The value of r is calculated as -

$$2^{R} \ge M + R + 1$$
  
$$\Rightarrow 2^{4} \ge 7 + 4 + 1$$

Therefore, the number of redundancy bits = 4

Now, let's calculate the required number of parity bits.

We take P = 2, then  $2^{P} = 2^{2} = 4$  and n + P + 1 = 4 + 2 + 1 = 7

The 2 parity bits are not sufficient for the 4-bit data.

Now, we will take P = 3, then  $2^{P} = 2^{3} = 8$  and n + P + 1 = 4 + 3 + 1 = 8

Therefore, 3 parity bits are sufficient for 4-bit data.

#### The total bits in the codeword are -4 + 3 = 7Position 1: checks the bits 1,3,5,7,9 and 11.

? \_1\_0 0 1\_1 0 1 0.In position 1 even parity so set position 1 to a 0:0\_1\_0 0 1\_1 0 1 0.

0 1 0	) 1	1 0	0	1	0
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## Position 2: checks bits 2,3,6,7,10,11.

0 ? 1\_0 0 1\_1 0 1 0. In position 2 odd parity so set position 2 to.a 1:0 1 1\_0 0 1\_1 0 1 0

## Position 4 checks bits 4,5,6,7,12.

0 1 1 ? 0 0 1\_1 0 1 0. In position 4 odd parity so set position 4 to.a 1: 0 1 1 1 0 0 1\_1 0 1 0

0	1	0	1		1	0	0	1	1	1	0
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## Position 8 checks bits 8,9,10,11,12

0 1 1 1 0 0 1 ? 1 0 1 0. In position 8 even parity so set position 8 to a 1: 0 1 1 1 0 0 1 0 1 0 1 0 1 0

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#### **Code Word = 011100101010**

0	1	1	1	0	0	1	0	1	0	1	0
0			1	0	0		0	1	0	1	0
-				-	-		-		-		-

## VII Recourses Required:

- Computer/Network Computer
- Turbo C.

## VIII Precautions to be followed:

- **1.** Handle equipment with care
- **2.** Follow safety Practices

## IX Procedure

The procedure used by the sender to encode the message encompasses the following steps -

- Step 1 Calculation of the number of redundant bits.
- Step 2 Positioning the redundant bits.
- **Step 3** Calculating the values of each redundant bit.
- Once the redundant bits are embedded within the message, this is sent to the user.

Decoding a message in Hamming Code

Once the receiver gets an incoming message, it performs recalculations to detect errors and correct them. The steps for recalculation are

- Step 1 Calculation of the number of redundant bits.
- **Step 2** Positioning the redundant bits.
- Step 3 Parity checking.
  - Step 4 Error detection and correction

#### Conclusion

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#### **XI** Practical related questions

- 1. Explain Error Correction?
- 2. Difference between Error detection and Error Correction.
- 3. Explain Advantages of hamming code method.
- 4. Calculate the number of parity bits required for given data (1011).

## Space for Answer

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- 1. Hamming Code in Computer Network Naukri Code 360
- 2. Error Correcting Codes Hamming codes (tutorialspoint.com)
- 3. Hamming Code in Computer Network GeeksforGeeks

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

**Practical No. 13:** \*Configure static IP address in operating system along with appropriate subnet mask for given problem

# I Practical Significance

An IP address is an address used in order to uniquely identify a device on an IP network. The address is made up of 32 binary bits, which can be divisible into a network portion and host portion with the help of a subnet mask. The 32 binary bits are divided into four octets (1 octet = 8 bits). Each octet is converted to decimal and separated by a period (dot). For this reason, an IP address is said to be expressed in dotted decimal format (for example, 192.168.50.100). The value in each octet ranges from 0 to 255 decimal, or 000000000 - 11111111 binary. Student should be able to configure static IP address in operating system along with appropriate subnet mask

# II Industry / Employer Expected Outcome(s)

1. Able to assign Static IP address to the machine along with appropriate subnet mask.

## III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services.

# IV Laboratory Learning Outcome(s)

LLO 13.1 Use IP address and appropriate subnet mask for given problem statement.

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background

## Internet Protocol (IP) Address

An Internet Protocol address (IP address) is a numerical label assigned to each device participating in a computer network that uses the Internet Protocol for communication. An IP address is an identifier for a computer or device on a TCP/IP network. Two versions of the Internet Protocol (IP) are in use: IP Version 4 (IPv4) and IP Version 6 (IPv6).

IPv4 addresses are of 32 bits that are canonically represented in dot-decimal notation, which consists of four decimal numbers, each ranging from 0 to 255, separated by dots e.g.,192.168.50.12.

IPv6 addresses are of 128 bits that are represented as eight groups of four hexadecimal digits separated by colons.

#### e.g. 2001:0db8:85a3:0042:1000:8a2e: 0370:7334

IP addresses are assigned to a host either dynamically as they join the network, or persistently by configuration of the host hardware or software. Persistent configuration is also known as using a static IP address. When a computer's IP address is assigned each time it restarts, this is known as using a dynamic IP address.

**Static IP Address:** It is manually configured for a device. Routers, phones, tablets, laptops, desktops can be configured to have a static IP address.

**Dynamic IP Address:** It is a temporary IP address assigned to a computing device or node when it is connected to a network. A dynamic IP address is an automatically configured IP address assigned by a DHCP server to every new network node. They are normally implemented by internet service providers and network that have a large number of connecting end nodes. The dynamic IP address is assigned to a node until it is connected to the network and hence a device may have different IP address every time it is connected to the network.

#### ✤ IP Address Classes:

In the IPv4 IP address space, there are five classes: A, B, C, D and E. Each class has a specific range of IP addresses. Primarily, class A, B, and C are used by the majority of devices on the Internet. Class D and class E are for special uses.

IP Address Class	IP Address Range (First octet decimal value)	
Class A	1-126 (00000001 to 01111110) *	
Class B	128-191 (10000000 to 10111111)	
Class C	192-223 (11000000 to 11011111)	
Class D	224-239 (11100000 to 11101111)	
Class E	240-255 (11110000 to 1111111)	
	twork, 16,777.000 available host address. ,384 networks,each supporting more then 65,000 hosts	
Class C small networks, m host.	ore than 2 million networks,each supporting up to 256	

#### Subnet Mask:

IP addresses contain two parts: a network identifier and a host identifier.

A **subnet mask** is a 32-bit number which is used to identify the subnet of an IP address. The subnet mask is combination of 1's and 0's. 1's represents network ID and 0's represents the host ID.

Class	Binary	Dotted-Decimal
А	11111111 0000000 0000000 0000000	255.0.0.0
В	11111111 11111111 00000000 00000000	255.255.0.0
С	11111111 11111111 11111111 00000000	255.255.255.0

# VII Recourses Required:

Desktop computers/Networked Computer

# VIII Precautions to be followed:

- **1.** Handle equipment with care
- **2.** Avoid the repetition of similar IP addresses on two or more PCs. It may cause IP conflict error in networking.
- **3.** Follow safety Practices

# IX Procedure

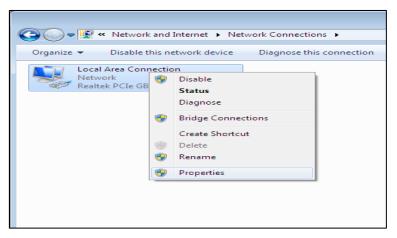
#### To set a static IP address on windows computer

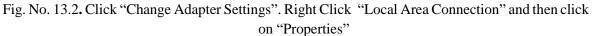
1. Click Start menu => control panel =>Network and Internet = >network and sharing center.

	I Items 🕨 Network and Sharing Center	▼   4 <sub>2</sub>	Search Control Panel	
Control Panel Home	View your basic network informat	tion and set u	p connections	
Change adapter settings	· · · · · · · · · · · · · · · · · · ·			See full m
Change advanced sharing settings	IFLAB1-04-PC Ne (This computer)	twork	Internet	
	View your active networks		Conn	ect or disconne
	Network Public network		ss type: Internet nections: 🏺 Local Area C	onnection
	Change your networking settings	а.		
	Set up a new connection or netwo Set up a wireless, broadband, dial- point.		N connection; or set up a	router or acces
	Connect to a network Connect or reconnect to a wireles	s, wired, dial-up,	or VPN network connectio	on.
	Choose homegroup and sharing options Access files and printers located on other network computers, or change sharing settings.			
See also	Access files and printers located o	n other network	computers, or change sha	ring settings.
HomeGroup	Troubleshoot problems Diagnose and repair network problems, or get troubleshooting information.			
Internet Options	plughose and repair network prob	ienis, or get trou	sicanooting information.	
Windows Firewall				

Fig. No. 13.1. Click Start menu => control panel =>Network and Internet = >network and sharing center.

2. Click "Change Adapter Settings". Right Click "Local Area Connection" and then click on "Properties"





3. Select Internet Protocol Version 4(TCP/IPv4). Click on "Properties"

4. Select "Use the following IP address" and enter the IP address, Subnet Mask, Default Gateway and DNS server. Click OK and Close the Local Area Connection properties window.

etworking		IPv4) Properties
Connect using:	General	
Realtek RTL8168D/8111D Family PCI-E Gigabit Ethemet		automatically if your network supports eed to ask your network administrator
his connection uses the following items:	Obtain an IP address auton	natically
Client for Microsoft Networks	Output Description of the second s	s:
Npcap Packet Driver (NPCAP)	IP address:	192 . 168 . 50 . 93
GoS Packet Scheduler     GoS Packet Scheduler     GoS Packet Scheduler     GoS Packet Scheduler	Subnet mask:	255.255.0.0
Internet Protocol Version 6 (TCP/IPv6)      Internet Protocol Version 4 (TCP/IPv4)	Default gateway:	192.168.50.1
Link-Layer Topology Discovery Mapper I/O Driver	Obtain DNS server address	automatically
	Ouse the following DNS served	er addresses:
Install Uninstall Properties	Preferred DNS server:	8.8.8.8
Description Transmission Control Protocol/Internet Protocol. The default	Alternate DNS server:	
wide area network protocol that provides communication across diverse interconnected networks.	Validate settings upon exit	Advanced
OK Cancel		OK Cancel

Fig. No. 13.3. Assign IP address, Subnet Mask, Default Gateway and DNS server

# X Conclusion

## XI Practical related questions

- 1. What is difference between static and dynamic address?
- 2. What is IP addressing? State and Explain IP Address Classes.
- 3. What is subnet mask? What is subnet mask for Class A, B and C?
- 4. What is Default gateway?

#### **Space for Answer**

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#### XII References:

1. https://nptel.ac.in/courses/106105183

2. https://www.pcmag.com/how-to/how-to-set-up-a-static-ip-address

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

**Practical No. 14:** \*Implement Classful Address in a given network node i) Identify range of IP Address in various classes ii) Justify the reason to choose various IP address classes for creating given network.

## I Practical Significance

An IPv4 address originally had a fixed-length prefix, but three fixed-length prefixes (n = 8, n = 16, and n = 24) were created in order to support both small and big networks. The entire address space was partitioned into five classes (classes A, B, C, D, and E). Classful addressing is the term used to describe address space of an IP address

# II Industry / Employer Expected Outcome(s)

- 1. Understand the concept of classful addressing
- 2. Understand and identify the classes of IP address

## III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services

# IV Laboratory Learning Outcome(s)

LLO 14.1 Implement IP addresses for intranet in Class A, Class B, Class C

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

## Classful Address

The IP address, often known as the Internet address, is the unique identifier used in the IP layer of the TCP/IP protocol suite to identify each device's connection to the Internet. A host's or router's connection to the Internet is defined by its 32-bit IPv4 address, which is unique and used worldwide. The network is defined by the first component of the address, known as the **prefix**, and the node is defined by the second component, known as the **Suffix** (connection of a device to the Internet).

The lengths of the prefix and suffix are n bits and (32 - n) bits, respectively. Prefixes can have variable or fixed lengths. The IPv4 network identification was initially intended to be a fixed-length prefix. classful **addressing** is the term used to describe this outmoded system. An IPv4 address originally had a fixed-length prefix, but three fixed-length prefixes (n = 8, n = 16, and n = 24) were created in order to support both small and big networks. As shown in the figure below, the entire address space was partitioned into five classes (classes A, B, C, D, and E). Classful addressing is the term used to describe this system.

#### **Classes of IP address**

Class A

Class A addresses are for networks with large number of total hosts. Class A allows for 126 networks by using the first octet for the network ID. The first bit in this octet, is always zero. The remaining seven bits in this octet complete the network ID. The 24 bits in the remaining three octets represent the hosts ID and allows for approximately 17 million hosts per network. Class A network number values begin at 1 and end at 127.

- Public IP Range: 1.0.0.0 to 127.0.0.0
- First octet value ranges from 1 to 127
- Private IP Range: 10.0.0.0 to 10.255.255.255
- Subnet Mask: 255.0.0.0 (8 bits)
- Number of Networks: 126
- Number of Hosts per Network: 16,777,214

## Class B

Class B addresses are for medium to large sized networks. Class B allows for 16,384 networks by using the first two octets for the network ID. The first two bits in the first octet are always 1 0. The remaining six bits, together with the second octet, complete the network ID. The 16 bits in the third and fourth octet represent host ID and allows for approximately 65,000 hosts per network. Class B network number values begin at 128 and end at 191.

- Public IP Range: 128.0.0.0 to 191.255.0.0
- First octet value ranges from 128 to 191
- Private IP Range: 172.16.0.0 to 172.31.255.255 (See Private IP Addresses
- Subnet Mask: 255.255.0.0 (16 bits)
- Number of Networks: 16,382
- Number of Hosts per Network: 65,534

## Class C

addresses are used in small local area networks (LANs). Class C allows for approximately 2 million networks by using the first three octets for the network ID. In a class C IP address, the first three bits of the first octet are always 1 1 0. And the remaining 21 bits of first three octets

complete the network ID. The last octet (8 bits) represents the host ID and allows for 254 hosts

per network. Class C network number values begin at 192 and end at 223.

- Public IP Range: 192.0.0.0 to 223.255.255.0
- First octet value ranges from 192 to 223
- Private IP Range: 192.168.0.0 to 192.168.255.255
- Special IP Range: 127.0.0.1 to 127.255.255.255
- Subnet Mask: 255.255.255.0 (24 bits)
- Number of Networks: 2,097,150
- Number of Hosts per Network: 254

Class D IP addresses are not allocated to hosts and are used for multicasting. Multicasting allows a single host to send a single stream of data to thousands of hosts across the Internet at the same time. It is often used for audio and video streaming, such as IP-based cable TV networks. Another example is the delivery of real-time stock market data from one source to many brokerage companies.

- Range: 224.0.0.0 to 239.255.255.255
- First octet value ranges from 224 to 239
- Number of Networks: N/A
- Number of Hosts per Network: Multicasting

Class E IP addresses are not allocated to hosts and are not available for general use. These are reserved for research purposes.

Range: 240.0.0.0 to 255.255.255 First octet value ranges from 240 to 255 Number of Networks: N/A Number of Hosts per Network: Research/Reserved/Experimental

## VII Recourses Required:

Network Computer

# VIII Precautions to be followed:

- **1.** Handle equipment with care
- **2.** Follow safety Practices

# IX Procedure

- 1. Visit to Your Computer Network Lab
- 2. Check the IP address assign to device
- 3. Understand and identify which types of class use in IP address
- 4. Justify the reason to choose IP address classes for creating network

X	Conclusion
	•••••••••••••••••••••••••••••••••••••••
	••••••
XI	Practical related questions
	1. Define IP address with Example
	<ol> <li>Difference between classfull and classless addressing</li> </ol>
	3. Explain classes of IP address with Example
	4. Identify the classes of IP address for 1) 192.158.1.38 2) 168.212.226
	Space for Answer
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#### XII References:

- 1. 5 Classes of IPv4 Addresses [Class A, B, C, D and E] (meridianoutpost.com)
- 2. Introduction to IP addressing and subnetting | TechTarget
- 3. Introduction of Classful IP Addressing GeeksforGeeks

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

## Practical No. 15: \*Execute TCP/IP network commands: ipconfig, ping, tracert

## I Practical Significance

The full form of TCP/IP is Transmission Control Protocol/Internet Protocol..TCP/IP is the key part of the fundamental structure of the system. It enables you to talk with another system just by implementing a program or command. Student should be able to study and run basic TCP/IP utilities and networking commands: ipconfig, ping, tracert.

# II Industry / Employer Expected Outcome(s)

1. Run TCP/IP Utilities: ipconfig, ping, tracert

2. Able to check configuration details of computer

3. Able to troubleshoot computer network by commands

# III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services

## IV Laboratory Learning Outcome(s)

LLO 15.1 Troubleshoot computer network using commands.

# V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

## **\*** TCP/IP utilities:

To assist with the management of TCP/IP. There are three types of TCP/IP-based utilities. 1. **Connectivity utilities** that you can use to interact with and use resources on a variety of systems.

2. Diagnostic utilities that you can use to detect and resolve networking problems.

**3. TCP/IP server software** that provides printing and publishing services to TCP/IP based Microsoft Windows client.

Utility Type	Examples (networking commands)
Connectivity	FTP, LPR, TELNET, TFTP, RSH, RCP
Diagnostic	Ping, Ipconfig, Tracert, ARP, Hostname
Server software	TCP/IP Printing service, Internet Information Services, Peer Web Services

## Ipconfig Command

**IPCONFIG** stands for **Internet Protocol Configuration**.

This Command Displays detailed information about all adapters, including the IP address,

subnet mask, default gateway, DHCP server, and DNS servers etc.

Used without parameters ipconfig displays the IP address, subnet mask, and default gateway for all adapters. By default, this command displays only the IP address, subnet mask, and default gateway for each adapter bound to TCP/IP.

## Syntax:

ipconfig [/allcompartments] [/? |/all |/renew [adapter] |/release [adapter] |/renew6 [adapter] | /release6 [adapter] |/flushdns |/displaydns |/registerdns |/showclassid adapter |/setclassid adapter [classid] |/showclassid6 adapter |/setclassid6 adapter [classid] ]

Following table shows use of ipconfig command with different options

Parameter	Description
/?	Displays the help message
/all	Displays complete configuration information
/release	Uses DHCP to release the IP address for the specified adapter
/release6	Uses DHCPv6 to release the IPv6 address for the specified adapter
/renew	Uses DHCP to renew the IP address for the specified adapter
/renew6	Uses DHCPv6 to renew the IPv6 address for the specified adapter
/flushdns	Purges the DNS cache
/registerdns	Uses DHCP to refresh all DHCP leases and re-registers DNS names
/displaydns	Displays the contents of the DNS cache
/showclassid	Displays all the DHCP class IDs allowed for the adapter

/setclassid	Modifies the DHCP class ID
/showclassid6	Displays all the DHCPv6 class IDs allowed for the adapter
/setclassid6	Modifies the DHCPv6 class ID
Select Administration Comm	config /all
Windows IP Configuration Host Name . Primary Dris Suffix Node Type IP Routing Enabled. MINS Proxy Enabled. DNS Suffix Search L	Casper Hybrid No
Ethernet adapter Ethern Media State Connection -specific Description PHYS Caabled Autoconfiguration En	DNS Suffix . : Media disconnected DNS Suffix . : : Realtek PCIe GBE Family Controller : EC-A8-68-06-86-51 nabled : Yes
Wireless LAN adapter Lo Media State Connection specific Description Physical Address DKCP Enabled Autoconfiguration Ér	: Microsoft Hosted Network Virtual Adapter : 20-E5-2A-EF-B2-FB
Connection-specific Description Physical Address . DHCP Enabled Autoonfiguration Er Subnet Mask Default Gateway . NetBIOS over Topip.	: VMware Virtual Ethernet Adapter for VMnet1 : 00-50-56-CO-00-01 nabled : Yes : 192.168.65.1(Preferred)

Fig.No. 15.1. Output screen of command C:\>ipconfig/all

## Ping Command

**PING** (**Packet Internet groper**): The ping command is the basic troubleshooting tool for TCP/IP.

It is a command used to verify the network connectivity of a computer. It uses a special protocol called the Internet Control Message Protocol (ICMP) to determine whether the remote machine (website, server, etc.) can receive the test packet and reply. This command is used to test a machine's connectivity to another system and to verify that the target system is active.

Usually, this command is the first step to any troubleshooting if a connectivity problem is occurring between two computers. The Ping utility executes an end-to-end connectivity test to other devices and obtains the round-trip time between source and destination device. Ping uses the ICMP Echo and Echo Reply packets to test connectivity. Excessive usage may appear to be a denial of service (DoS) attack.

Syntax: ping <ip address>

ping [-t] [-a] [-n count] [-l size] [-f] [-i TTL] [-v TOS][-r count] [-s count] [[-j host-list]] [-k host-list]][-w timeout] [-R] [-S srcaddr] [-c compartment] [-p][-4] [-6] target\_name

Following table shows use of ping command with different options

Parameter	Description
-t	Pings the specified host until interrupted (press Ctrl+C to stop
	sending).
-a	Resolves addresses to hostnames.
-n count	Indicates the number of Echo Requests to send.
-1 size	Sends a specific size of data. If this size is greater than the local network can handle, the sender will generate fragmented packets directly on the network.
-f	Sets the Don t Fragment flag in the packet.
-i TTL	Sets the Time to Live value in the packet.
-vTOS	Sets the type of service in the packet.
-r count	Indicates that the Ping process should record the route for the number of count hops specified.
-s count	Indicates that the Ping process should maintain Timestamp information for the number of count hops specified.
-j host_list	Indicates that the Ping process should follow a loose source route path along the host_list path
-k host_list	Indicates that the Ping process should follow a strict source route along the host_list path.
-w timeout	Indicates the number of milliseconds the host should wait for each reply.
-R	Use the router header to test the reverse route as well (IPv6 only).
-S srcaddr	What address to use to source ping from.
-р	Ping yper-V Network Virtualization provider address.
-4	Use IPv4 specifically.
-6	Use IPv6 specifically.

• Example 1

```
Microsoft Windows [Version 10.0.14393]
(c) 2016 Microsoft Corporation. All rights reserved.
C:\Users\Matt>ping 122.56.77.17
Pinging 122.56.77.17 with 32 bytes of data:
Reply from 122.56.77.17: bytes=32 time=15ms TTL=247
Reply from 122.56.77.17: bytes=32 time=18ms TTL=247
Reply from 122.56.77.17: bytes=32 time=20ms TTL=247
Reply from 122.56.77.17: bytes=32 time=15ms TTL=247
Ping statistics for 122.56.77.17:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 15ms, Maximum = 20ms, Average = 17ms
```

Fig.No. 15.2. Output screen of command C:\>ping

#### • Example 2

Command Prompt
C:\>ping www.gmail.com
Pinging www.gmail.com [2404:6800:4009:81c::2005] with 32 bytes of data: Reply from 2404:6800:4009:81c::2005: time=71ms Reply from 2404:6800:4009:81c::2005: time=66ms Reply from 2404:6800:4009:81c::2005: time=72ms Reply from 2404:6800:4009:81c::2005: time=78ms
<pre>Ping statistics for 2404:6800:4009:81c::2005: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 66ms, Maximum = 78ms, Average = 71ms C:\&gt;</pre>

#### Fig.No. 15.3. Output screen of command C:\>ping

If the connection is successful, you will see a series of responses displaying the round-trip time, indicating that your internet connection is working. To stop pinging we should use ctrl+c otherwise it will keep on sending packets.

Here,

- **min:** minimum time to get a response
- **avg:** average time to get responses
- max: maximum time to get a response
- Tracert (traceroute)

In the internet, data packets travel through a series of routers before reaching their destination. Tracert is a command that allows you to trace this path.

It traces the route taken by your data, revealing each hop (router) it encounters and the time it takes to reach it.

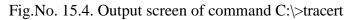
Syntax: tracert<ip address>

tracert [-d] [-h maximum\_hops] [-j host-list] [-w timeout] [-R] [-S srcaddr] [-4] [-6] target\_name

Parameter	Description
-d	Tells the system not to resolve addresses to host names
-h maxHops	Specifies the maximum number of hops to search for target
-w timeout	Specifies the number of milliseconds to wait for each reply
-4	Specifies to use IPv4 specifically
-6	Specifies to use IPv6 specifically
-R	Trace round-trip path (IPv6-only).
-S srcaddr	Source address to use (IPv6-only).

Following table shows use of tracert command with different options.

Command Prompt C:\>tracert www.gmail.com Tracing route to www.gmail.com [2404:6800:4009:82f::2005] over a maximum of 30 hops: 155 ms 227 ms 158 ms 2409:4042:4e0a:e882::d9 1 Request timed out. 270 ms 318 ms 157 ms 2405:200:382:eeee:20::358 113 ms 158 ms 318 ms 2405:200:801:1d00::229 \* Request timed out. 6 Request timed out. 158 ms 330 ms 2001:4860:1:1::331c 309 ms 8 148 ms 152 ms 2001:4860:1:1::331c 304 ms 311 ms 2001:4860:0:1::877d 9 268 ms 166 ms 10 100 ms 319 ms 158 ms 2001:4860:0:1::3ff 269 ms 318 ms 158 ms bom12s19-in-x05.1e100.net [2404:6800:4009:82f::2005] 11 Trace complete. C:\>



After running the Tracert command, you'll be presented with a list of hops, each showing the time taken for your data to travel.

# VII Recourses Required:

VIII

IX

Х

• Computer / Networked Computers

Precautions to be followed:
1. Handle Computer system and peripherals with care.
2. Follow safety Practices
Procedure
1. Open Command Prompt
2. Run Utilities with options
Conclusion
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XI	Practical related questions
	1. What is a purpose of TCP/IP utilities. Give the use of connectivity utility and also write 2 examples of it.
	2. Give the name of commands to find out hostname and MAC address of computer.
	3. Which are the different things are checked using ping command?
	4. Give a syntax of tracert command.
	5. What is a use of "/release" and " /renew" option used in lpconfig?
	Space for Answer
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2. https://www.pluralsight.com/blog/it-ops/top-7-tcpip-utilities-every-networking-pro-should-know

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# Practical No. 16: \*Execute TCP/IP network commands: netstat, pathping, route

# I Practical Significance

Student should be able to study and run basic TCP/IP utilities and networking commands: netstat, pathping, route.

# II Industry / Employer Expected Outcome(s)

1. Run TCP/IP Utilities: netstat, pathping, route

2. Able to trace travelling route of transmitted message or data packet.

3. Able to display network statistics

## III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services

#### Laboratory Learning Outcome(s)

LLO 16.1 Troubleshoot computer network using commands.

# V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

### Netstat (network statistics) Command:

Netstat displays protocol statistics and current TCP/IP network connections. netstat allows users to display network-related information and diagnose various networking issues. The command has several options that can be combined to retrieve specific details.

#### Syntax:

IV

netstat [-a] [-b] [-e] [-f] [-n] [-o] [-p proto] [-r] [-s] [-t] [-x] [-y] [interval]

Following table shows	use of netstat command	with different options
$\mathcal{O}$		1

Option	Description				
-a	Displays all connections and listening ports.				
-b	Displays the executable involved in creating each connection or listening port.				
	In some cases, well-known executables host multiple independent components,				
	and in these cases the sequence of components involved in creating the				
	connection or listening port is displayed. In this case the executable name is in				
	[] at the bottom, on top is the component it called, and so forth until TCP/IP				
	was reached. Note that this option can be time-consuming and will fail unless				
	you have sufficient permissions.				
-е	Displays Ethernet statistics. This may be combined with the -s option.				
-f	Displays Fully Qualified Domain Names (FQDN) for foreign addresses.				
-n	Displays addresses and port numbers in numerical form.				
-0	Displays the owning process ID associated with each connection.				
-р	Shows connections for the protocol specified by proto; proto may be any of:				
proto	TCP, UDP, TCPv6, or UDPv6. If used with the -s option to display per-				
	protocol statistics, proto may be any of: IP, IPv6, ICMP, ICMPv6, TCP,				
	TCPv6, UDP, or UDPv6.				
-q	Displays all connections, listening ports, and bound nonlistening TCP ports.				
	Bound nonlistening ports may or may not be associated with an active				
	connection.				
-r	Displays the routing table.				
-S	Displays per-protocol statistics. By default, statistics are shown for IP, IPv6,				
	ICMP, ICMPv6, TCP, TCPv6, UDP, and UDPv6; the -p option may be used to				
	specify a subset of the default.				
-t	Displays the current connection offload state.				
-X	Displays Network Direct connections, listeners, and shared endpoints.				
-у	Displays the TCP connection template for all connections. Cannot be				
	combined with the other options.				
interval	Redisplays selected statistics, pausing interval seconds between each display.				
	Press CTRL+C to stop redisplaying statistics. If omitted, netstat will print the				
	current configuration information once.				

Comm	and Prompt			—	×
C:\>nets	tat				
Active C	onnections				
Proto	Local Address	Foreign Address	State		
TCP	127.0.0.1:25982	DESKTOP-7180E6L:62474	ESTABLISHED		
TCP	127.0.0.1:62474	DESKTOP-7180E6L:25982	ESTABLISHED		
TCP	192.168.43.227:56389	20.212.88.117:https	ESTABLISHED		
TCP	192.168.43.227:58053	192.168.43.124:domain	SYN_SENT		
TCP	192.168.43.227:58054	49.44.136.33:https	SYN_SENT		
TCP	192.168.43.227:58854	49.44.199.137:https	ESTABLISHED		
TCP	192.168.43.227:59265	52.168.112.66:https	FIN_WAIT_1		
TCP	[2409:4042:4e0a:e882:9	d75:c32b:77f9:a853]:523	22 [2603:1047:1:98::80]:https SYN_SENT		
TCP	[2409:4042:4e0a:e882:9	d75:c32b:77f9:a853]:563	80 [2404:6800:4003:c03::bc]:https ESTABLISHED		
TCP	[2409:4042:4e0a:e882:9	d75:c32b:77f9:a853]:588			
TCP	[2409:4042:4e0a:e882:9	d75:c32b:77f9:a853]:592	21 [2405:200:1602::312c:824d]:https ESTABLISHED		
C:\>					

Fig.No. 16.1. Output of netstat command

### ✤ Pathping Command:

This network utility is a more advanced version of the Ping tool, which performs a ping to each hop along the route to the destination (unlike Ping, which just pings from the originating device to the destination device). It is extremely useful in diagnosing packet loss, and can help with diagnosing slow speed faults.

Pathping is a TCP/IP based utility (command-line tool) that provides useful information about network latency and network loss at intermediate hops between a source address and a destination address. It does this by sending echo requests via ICMP and analyzing the results.

### Syntax:

pathping [-g host-list] [-h maximum\_hops] [-i address] [-n] [-p period] [-q num\_queries][-w timeout][-4] [-6] target\_name

Following table shows use of pathping command with different options

Option	Description
-g <host-list></host-list>	Loose source route along host-list.
-h	Maximum number of hops to search for target
<maximum_hops></maximum_hops>	
-i <address></address>	Use the specified source address.
-n	Do not resolve addresses to hostnames.
-p <period></period>	Wait period milliseconds between pings.
-q <num_queries></num_queries>	Number of queries per hop.
-w <timeout></timeout>	Wait timeout milliseconds for each reply.
-4	Force using IPv4.
-6	Force using IPv6.

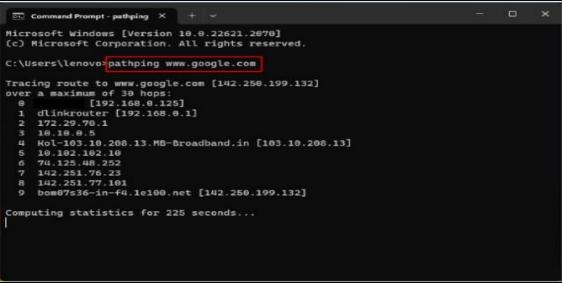


Fig.No. 16.2. Output of pathping command

**Note**: You can interrupt PathPing at any time by holding down the **CTRL** key, and pressing **C** on your keyboard.

### Route Command:

This command manipulates network routing tables.

Route command is only available if the TCP/IP protocol is installed as a component in the properties of a network adapter.

Route command displays or modifies the computer's routing table information. For a typical computer that has a single network interface and is connected to a local area network (LAN) that has a router, the routing table is pretty simple. If user facing trouble in accessing other computers or other networks, user can use the route command to investigate bad entry that affect in the computer's routing table.

For a computer with more than one interface and that's configured to work as a router, the routing table is often a major source of trouble. Setting up the routing table properly is a key part of configuring a router to work.

Earlier tracert command is used to trace the travel of packet from source to destination over a network. This command is capable to modify routing table entries hence the route command is established. To display the routing table (both IPv4 and IPv6) in Windows, use the route print command.

### Syntax:

route [-f] [-p] [-4|-6] command [destination][MASK netmask] [gateway] [METRIC metric] [IF interface]

Route command syntax finds and displays following information for each entry in the routing

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table, five items of information are listed:

• The destination IP address, this is the address of the destination subnet, and must be interpreted in the context of the subnet mask.

• The **subnet mask** that must be applied to the destination address to determine the destination subnet

• The **IP address of the gateway** to which traffic intended for the destination subnet will be sent

• The IP address of the interface through which the traffic will be sent to the destination subnet

• The metric, which indicates the number of hops required to reach destinations via the gateway

Option	Description			
-f	Clears the routing table			
-P	When used with the ADD command, makes a route persistent across boots of the system. By default, routes are not preserved when the system is restarted. Ignored for all other commands, which always affect the appropriate persistent routes.			
Command	The command to run (add, change, delete, print)			
-4	Force using IPv4			
-6	Force using IPv6			
Destination	Network destination of the route			
mask Netmask	The netmask (subnet mask) associated with the network destination			
Gateway	Specifies gateway			
metric Metric	specifies the metric, ie. cost for the destination.			
Interface	the interface number for the specified route.			
/?	Command help			

Most of the times this command syntax is used with print option like Route print command.

### syntax

route print [-f] [-p] [-4|-6] [Command [Destination] [mask Netmask] [Gateway] [metric Metric]] [if Interface]] >

Command Prompt						_	×
Interface List 16d8 cb 8a d1 402 ad a7 31 900 ad a7 31 1000 ad a7 31 1	6a b2Intel( 2e f4Micros 2e f4Realte 2e f4Softwa	R) Ethernet Conn oft Wi-Fi Direct oft Wi-Fi Direct k RTL8188EU Wire re Loopback Inter	ection I217-LM Virtual Adapter Virtual Adapter less LAN 802.11n rface 1	#2 USB 2.0	Network Adapter		Í
IPv4 Route Table =======Active Routes:							
Network Destinatio	on Netmask	Gateway	Interface	Metric			
0.0.0.0	0.0.0.0		192.168.43.227	55			
127.0.0.0	255.0.0.0	On-link	127.0.0.1	331			
127.0.0.1	255.255.255.255	On-link	127.0.0.1	331			
127.255.255.255	255.255.255.255	On-link	127.0.0.1	331			
192.168.43.0	255.255.255.0	On-link	192.168.43.227	311			
192.168.43.227	255.255.255.255	On-link	192.168.43.227	311			
192.168.43.255	255.255.255.255	On-link	192.168.43.227	311			
224.0.0.0	240.0.0.0	On-link	127.0.0.1	331			
224.0.0.0	240.0.0.0	On-link	192.168.43.227	311			
255.255.255.255	255.255.255.255	On-link	127.0.0.1	331			
255.255.255.255	255.255.255.255	On-link	192.168.43.227	311			
Persistent Routes: None							

Fig.No. 16.3. Output of route command

# VII Recourses Required:

• Computer / Networked Computers (With Internet connectivity)

# VIII Precautions to be followed:

1. Handle Computer system and peripherals with care.

2. Follow safety Practices

# IX Procedure

- 1. Open Command Prompt
- 2. Run Utilities with options

# X Conclusion

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#### XI Practical related questions

- 1. Which are different statistics display for TCP using Netstat utility?
- 2. What is a use of pathping command?
- 3. Execute the syntax of Route command with any two options
- 4. Give syntax of commands for adding, deleting IP addresses from routing table.

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3. https://en.wikipedia.org/wiki/Route\_(command)

## XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

**Practical No. 17:** \*Install Wireshark and configure as packet sniffer - i) Capture IP, TELNET, FTP packets using Wireshark

# I Practical Significance

**Wireshark** is a free and open-source packet analyzer. It is used for network troubleshooting, analysis, software and communications protocol development, and education. Student should be able to install and configure as a packet sniffer.

### Industry / Employer Expected Outcome(s)

**II** 1. Able to install and configure Wireshark.

2. Able to Capture IP, TELNET and FTP packets

# III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services

# IV Laboratory Learning Outcome(s)

LLO 17.1 Use Wireshark packet sniffer software.

# V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background

### ✤ Wireshark

Wireshark is a network packet analyzer. A network packet analyzer presents captured packet data in as much detail as possible. Wireshark is completely free and open source. This packet analyzer is used for a variety of purposes like to troubleshoot network problems, to examine security problems, to verify network applications, to debug protocol implementations, to learn network protocol internals etc.

Wireshark is the most often-used packet sniffer in the world. A packet sniffer is also known as a packet analyzer, protocol analyzer or network analyzer is a piece of hardware or software used to monitor network traffic.

The original name of Wireshark was Ethereal which was changed in 2006. Wireshark is a crossplatform software, it can be run on Linux, windows, mac, and any other operating system.

## ✤ IP Packet

In most computer networks, data is broken down into small units called packets and sent between devices. The same holds true on the internet. Each packet has a specific structure, defined by a protocol, that allows the recipient to understand the packet's contents. An IP packet is a unit of data in a network that contains information about the source and destination addresses and other control information needed to transport the packet over a network.

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VER HEL	Sevice Type	Total Length			
bits 4 bits	8 bits	16 bits			
Datagram Id	entification	Flags	Fragment offset		
16 1	oits	3 bits	13 bits		
Time To Live	Protocol	H	leader Checksum		
8 bits	8 bits		16 bits		
	Source	IP Address			
	32	2 bits			
	Destinatio	on IP Address			
32 bits					

Fig. No. 17.1. IPv4 Header format

### Telnet Packet

**Telnet** (short for "teletype network") is a client/server application protocol that provides access to virtual terminals of remote systems on local area networks or the Internet. It follows a user command TCP/IP networking protocol that creates remote sessions.

## \* FTP

FTP (File Transfer Protocol) is a network protocol for transmitting files between computers over Transmission Control Protocol/Internet Protocol (TCP/IP) connections. Within the TCP/IP suite, FTP is considered an application layer protocol.

## ✤ Steps to install Wireshark on Windows:

### Follow the below steps to install Wireshark on Windows:

1. Open the web browser.

2. Search for 'Download Wireshark' or Visit Official Wireshark website

### https://www.wireshark.org/download.html.

3: Click on Download, a new webpage will open with different installers of Wireshark.

4. Downloading of the executable file will start shortly.

5. Now check for the executable file in downloads in your system and run it.

6. It will prompt confirmation to make changes to your system. Click on Yes.

7. Setup screen will appear, click on Next.

8. The next screen will be of License Agreement, click on Noted.

9. Next screen is for choosing components, all components are already marked so don't change anything just click on the Next button.

10. Next screen is of choosing shortcuts like start menu or desktop icon along with file extensions which can be intercepted by Wireshark, tick all boxes and click on Next button.

11. The next screen will be of installing location so choose the drive which will have sufficient memory space for installation.

12. Next screen has an option to install Npcap which is used with Wireshark to capture packets. *pcap* means packet capture so the install option is already checked don't change anything and click the next button.

13. Next screen is about USB network capturing so it is one's choice to use it or not, click on Install.

14. After this installation process will start.

15. This installation will prompt for Npcap installation as already checked so the license agreement of Npcap will appear to click on the *I Agree* button.

16. Next screen is about different installing options of *npcap*, don't do anything click on Install.

17. After this installation process will start which will take only a minute.

18. After this installation process will complete click on the Next button.

19. Click on Finish after the installation process is complete.

20. After this installation process of Wireshark will complete click on the Next button.

21. Click on Finish after the installation process of Wireshark is complete.

Wireshark is successfully installed on the system and an icon is created on the desktop as shown below:



Fig. No.17.2. Wireshark icon

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Fig. No.17.3. Wireshark software

# VII Recourses Required:

- Computer / Networked Computers (with internet connectivity)
- Wireshark Software (Open-source software)

# VIII Precautions to be followed:

- 1. Handle Computer system and peripherals with care.
- 2. Follow safety Practices

# IX Procedure Select a Network Interface to Capture Packets through.

1. Start the Wireshark application.

2. List of network interfaces is available on the screen

3. select network interface to capture packets.

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Fig. No.17.4. Selection of Network interface

#### • To capture network traffic by using Wireshark:

To capture network traffic, click the Start button for the network interface you want to capture traffic on.

	Wi-Fi			
File	Edit	View	Go	Capture
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	pply a	display f	ilter	<ctrl-></ctrl->

Fig No.17.5.Start button to capture Network traffic

Generate some network traffic with a Web Browser. Your Wireshark window should show the packets, and now look something like

				5. 32 20	
Bett		Egression. Cese Apply			
. Tana	Source	Destination	Postelal	Iste .	
54 5. 354882	192,164,1,2	204, 11, 246, 48	TEP	45823 = Http [ACK] Seg-830 ACk-2971 wim-17184 Lam-0	
15 1. 172682	107,108.1.7	204, 11, 246, 48	TC#	45823 > HELD [SVN] 500-0 Wine8192 Lane0 H55+1000 w5-2	
36 1.063477	192,168.1,2	204.11.246.48	NTTP	GET /crypto-gram-back.html HTTP/2.3	
6 0.259568	192.168.1.2	204.11.246.48	NTTP	GET /favicon.ico wTTP/1.1	
26 1.881706	192.168.1.2	204.11.246.48	NTTP	GET /Images/book-sos-175w.jpg HTTP/1.1	Packet
23 1.781484	197.168.1.2	204-31.246-48	HITTP	ART PROVIDE HER HAR REAL STREET, 213	
29 2.005674	192.168.1.2	204.33.246.48	HTTP	GET /Schreter.CSS HTTP/2_1	List Pane
45 2, 215103 28 2,002906	204.13.248.48	192,168,1,2	NTTP	HTTP/1.1 200 DE (JPEG 3F3F 1Hage)	
40 2.229787	204.11.240.48	192.168.1.2		WFTP/1.1 200 04 [1est/css] WFTP/1.1 200 04 [1est/css]	
24 1,862730	204.11.246.48	192.168.1.2	-	HTTP/1.1 200 OK (Text/Text)	
8 0,473800	204, 11, 240, 48	192,168,1.2	NTTP	HTTP/1.1 404 Not Found (text/bin1)	
47 2.209768	192,168,1,2	197,168,2.1	DNS	Standard puery & week, bt, con	
1 0.000000	192,168,1,2	197,168.3.1	DMS	Standard query A was.schneter.com	
46 2, 367405	197.168.1.7	197,168,2.1	OAS	Standard query A zeutness, con	
2 0.046304	192,168.1.1	192, 568, 5, 2	OAIS	standard query response a 204,11,346,48	
Ethernet II, Srci LI Internet Protocol, S	on wire, 473 bytes captured) teente_a9:f5:5e (00:22:5f:a9:f) rc: 192.168.1.2 (192.168.1.2),	DST: 204.11.246.48 (2	04.11.246.48	0	
Athernet II, SrCi L Internet Protocol, s Transmission Control Hypertaxt Transfer P	tteomTe_a0:f5:5e (00:22:3f:a0:f) Prc: 192.168.1.2 (192.166.1.2), I Protocol, prc Port: 45823 (45) Wotocol	DST: 204.11.246.48 (2 23), DST Port: http (	04.11.246.48	0	
Athermet 21, Brits A Bittermet 70, Brits A Transmission Control managins for Control Managins and State Request Method: Request Method: Request Werline User Agent: Muril Accept - Lenguage: 4 Accept - Lenguage:	teentre_ast f5:14: 000:22:35:ast, Fronteel, 32:165:12:052:165:12:05 Fronteel, 32:36:45:12:052:1655:12:05 Fronteel, 35:05:05 Fronteel, 35:05:05 Fronteel, 35:05 Fronteel, 3	Det: 204.11.246.48 (2 23), Dat Port: http ( e.css HTTP/1.1.9-0) -0: en-08: rv:1.0.1.4	04.11.246.41 80), Seq: 3.	0	Packet Details Panel

Fig. No.17.6. Wireshark software shows packets by using three panels

The capture is split into 3 parts:

Packet List Panel – This is a list of packets in the current capture. It colors the packets based on the protocol type. When a packet is selected, the details are shown in the two panels below.
 Packet Details Panel – This shows the details of the selected packet. It shows the different

protocols making up the layers of data for this packet. Layers include Frame, Ethernet, IP, TCP/UDP/ICMP, and application protocols such as HTTP.

**3.** Packet Bytes Panel – shows the packet bytes in Hex and ASCII encodings.

#### To stop the capture

Select the Capture->Stop menu option, Ctrl+E, or the Stop toolbar button. What you have

created is a Packet Capture, which you can now view and analyse using the Wireshark interface, or save to disk to analyse later.

### Wireshark Display Filters.

Wireshark automatically generates a Display Filter, and applies it to the capture. The filter is shown in the Filter Bar, below the button toolbar. The window should be similar to that shown in Fig.No.17.7.

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Fig. No.17.7.Display filter in Wireshark software

### • Capture IP packets using Wireshark

IP Filtering is a simple mechanism or process that defines which kinds of IP Datagrams are running on your system, like a source IP address is coming and a Destination IP is outgoing.

Description	Filter Expression
Capture only traffic to or from IP address 192.168.43.227:	ip.addr ==192.168.43.227
Capture only traffic from source IP address 192.168.43.227:	ip.src ==192.168.43.227
Capture only traffic to destination IP address 192.168.43.227:	ip.dst ==192.168.43.227

Steps to Capture only traffic to or from IP address 192.168.43.227:

1. go to display filter

2. type ip.addr ==192.168.43.227 and press enter

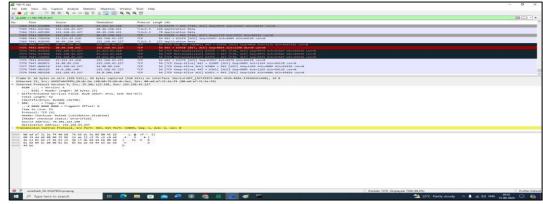


Fig. No.17.8. Capture IP packets by using Wireshark software

#### • To check IP header information

1. Go to Wireshark => type "http" in display filter => start capturing packets

2. Go to browser => Visit any website

3. In Wireshark, stop capturing packets

<pre>Line in 4. GET /HFEuTzBHHEsuSTADBgUrDgMCGgUABBADC910TxH4GeyRjyTl2r4yTUczyAQUfVxxxf5tiuF342v5muKhuA0W4ECEF 3. Response 3. GET /JRExuISHHEmQTADBgUrDgMCGgUABBADC910TxH4GeyRjyTl2r4yTUczyAQUfVxxf5tiuF342v5muKhuA0W4ECEF 4. GET /gelgStaC212tr1 HTTP171 4. GET /RefigStaC22tr1 HTTP171 4. GET /HExtFBHEsuSTADBgUrDgMCGgUABBACS126wHACK42guwUSH6TgQUQHK3347HHIMu0jFXX282yEBUQ4gH4 4. GET /gelgStaC21rc1 HTTP171 4. GET /HExtFBHEsuSTADBgUrDgMCGgUABBACS11H4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /gelgStaC21rc1 HTTP171 4. GET /HExtFBHEsuSTADBgUrDgMCGgUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HExtFBHEsuSTADBgUrDgMCGgUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HExtFBHEsuSTADBgUrDgMCGgUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HExtFBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HExtFBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HExtFBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HFStrTBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HFStrTBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HFStrTBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HFStrTBHEsuSTADBgUrDgMCGGUABBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECEF 5. GET /HFStrTBHEsuSTADFGUADBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECF 5. GET /HFStrTBHEsuSTADFGUADBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF382v5muXhuA0AV4ECF 5. GET /HFStrTBHEsuSTADFGUADBACS10TxH4GeyRjyTl2r4yTUczyAQUfVxxF5t1uF370TxH4GAC446}, 104044 5. GET /HFStrTBHEsUSTADFGUADBACS10TxH4GeyRjyTl2r4yTUczyAGUAS450C4550 5. GET /HFStrTBHEsUSTADFGUADBAC46550 5. GET /HFStrTBHESTADFGUADBACS10TxH4GeYRjyTl2r4yTUCzyAGUAS450C4550 5. GET /HFStrTBHESTADFGUADBAC4550 5. GET /HFStrTBHESTADFGUADBAC45550075000C4550075000C4550 5. GET /HFS</pre>
7506, Dat Port: 00, Seq: 1, Ack: 1, Len: 230

Fig. No. 17.9. HTTP packet

4. Double click on "http" as shown in above fig

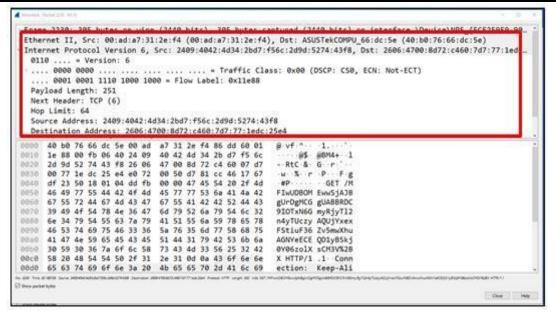


Fig. No.17.10. IP Header Information

# X Conclusion

#### **XI** Practical related questions

- 1. What is wireshark?
- 2. Write usage of wireshark.
- 3. What is use of Npcap software? Is it necessary to install for wireshark? Why?
- 4. State any four Wireshark Capture Options.
- 5. What is "Display filter" and "Capture filter"?

#### **Space for Answer**

Maharashtra State Board of Technical Education ('K' Scheme)

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#### XII References:

- 1. https://www.geeksforgeeks.org/how-to-install-wireshark-on-windows/
- 2. https://wiki.wireshark.org/CaptureFilters
- 3. https://youtu.be/AgAE8zkBoHk?si=ekhlrDg8PLn2lx-6
- 4. https://www.youtube.com/watch?v=AWERzjGEyRU

## XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# Practical No. 18: Capture TCP and UDP packet using Wireshark

## I Practical Significance

Transmission Control Protocol is a connection-oriented protocol for communications that helps in the exchange of messages between different devices over a network. User Datagram Protocol (UDP) is a Transport Layer protocol. UDP is a part of the Internet Protocol suite, referred to as UDP/IP suite. Unlike TCP, it is an unreliable and connectionless protocol. Student should be able to capture TCP and UDP Packet using Wireshark.

# II Industry / Employer Expected Outcome(s)

1. Able to capture TCP and UDP Packet using Wireshark.

# III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services

# IV Laboratory Learning Outcome(s)

LLO 18.1 Measure various types of Delay by using Wireshark.

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

✤ TCP

**TCP** (**Transmission Control Protocol**) is one of the main protocols of the Internet protocol suite. The position of TCP is at the transport layer of the OSI model. Transmission Control Protocol is a connection-oriented protocol for communications that helps in the exchange of messages between different devices over a network. The Internet Protocol (IP), which establishes the technique for sending data packets between computers, works with TCP. TCP also helps in ensuring that information is transmitted accurately by establishing a virtual connection between the sender and receiver.

### Working of Transmission Control Protocol (TCP)

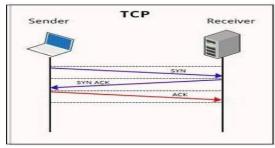


Fig. No.18.1. Working of TCP

When a user requests a web page on the internet, somewhere in the world, the server processes that request and sends back an HTML Page to that user. The server makes use of a protocol called the HTTP Protocol. The HTTP then requests the TCP layer to set the required connection and send the HTML file.

Now, the TCP breaks the data into small packets and forwards it toward the Internet Protocol (IP) layer. The packets are then sent to the destination through different routes.

The TCP layer in the user's system waits for the transmission to get finished and acknowledges once all packets have been received.

**Transmission Control Protocol (TCP)** provides a secure and reliable connection between two devices using the 3-way handshake process. TCP uses the full-duplex connection to synchronize (SYN) and acknowledge (ACK) each other on both sides. There are three steps for both establishing and closing a connection. They are – SYN, SYN-ACK, and ACK

**Step 1 (SYN):** In the first step, the client wants to establish a connection with a server, so it sends a segment with SYN (Synchronize Sequence Number) which informs the server that the client is likely to start communication and with what sequence number it starts segments with

**Step 2 (SYN + ACK):** Server responds to the client request with SYN-ACK signal bits set. Acknowledgement (ACK) signifies the response of the segment it received and SYN signifies with what sequence number it is likely to start the segments with

**Step 3 (ACK):** In the final part client acknowledges the response of the server and they both establish a reliable connection with which they will start the actual data transfer

-	→ 32 bits →								
	Source Po	rt	Desti	ination Port					
	Se	quence	Numbe	er					
	Acknow	ledgemen	t Number						
Data Offset	Reserved			Window (sliding window)					
	Checksun	n	Urgent Pointer						
	Op	otions		Padding					
		Da	ata						

# **TCP Header Format:**

Fig. No.18.2. TCP Header Format

# ✤ UDP

**User Datagram Protocol (UDP)** is a Transport Layer protocol. UDP is a part of the Internet Protocol suite, referred to as UDP/IP suite. Unlike TCP, it is an **unreliable and connectionless protocol.** So, there is no need to establish a connection before data transfer. The UDP helps to establish low-latency and loss-tolerating connections over the network. The UDP enables process-to-process communication.

## Working of User Datagram Protocol (UDP)

UDP uses IP to get a datagram from one computer to another. UDP gathers data in a UDP packet and adds its own header information to the packet. This data consists of the source and destination ports on which to communicate, the packet length and a checksum. After UDP packets encapsulate in an IP packet, it sends packets off to their destinations. However, unlike other protocols such as TCP, UDP simplifies data transfer by sending packets directly to the receiver without first establishing a two-way connection. UDP does not indicate the transmission order for its datagrams or even confirm their arrival.

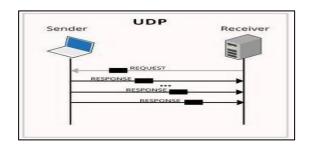


Fig. No.18.3. Working of UDP

## **UDP Header Format:**

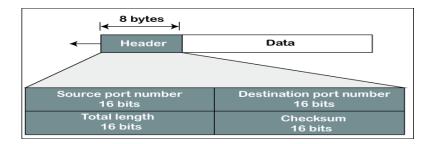


Fig.No.18.4.UDP Header format

# VII Recourses Required:

- Computer / Networked Computers (with internet connectivity)
- Wireshark Software (Open-source software)

# VIII Precautions to be followed:

- 1. Handle Computer system and peripherals with care.
- 2. Follow safety Practices

# IX Procedure

### Steps to Capture TCP packets

- 1. Go to display filter
- 2. Type "tcp " and press enter

	Time Source	Destination	Protocol	Length Timesince pr	evious frame in this TCP stream Info
	10.00002404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.000000000 443 → 54507 [ACK
	2 0.0000 2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.00000000 443 - 54507 [ACK
	30.00252404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.002596000 443 - 54507 [ACK
	40.00252404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.00000000 443 - 54507 [ACK
	50.0877 2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TLSv1.2	581	0.085160000 Application Data
	150.1414 192.168.43.227	35.190.53.226	TCP	66	0.00000000 54537 - 443 [SYI
	160.1414 192.168.43.227	35.190.53.226	TCP	66	0.000013000 [TCP Retransmis:
	17 0.1417 2409:4042:4d34:2bd7:1d20:d40	2404:6800:4009:803::200e	TCP	74	0.053959000 54507 - 443 [AC
	18 0.1417 2409:4042:4d34:2bd7:1d20:d40	2404:6800:4009:803::200e	TCP	74	0.000010000 [TCP Dup ACK 174
	190,184735,190,53,226	192.168.43.227	TCP	66	0.043325000 443 → 54537 [SYI
	200.1849 192.168.43.227	35.190.53.226	TCP	54	0.000212000 54537 - 443 [ACK
	21 0.1849 192.168.43.227	35.190.53.226	TCP	54	0.000010000 [TCP Dup ACK 201
	220.2290192.168.43.227	35.190.53.226	TLSv1.3	571	0.044045000 Client Hello (SM
	23 0.2290 192.168.43.227	35.190.53.226	TCP	571	0.000009000 [TCP Retransmis:
	24 0.2942 35.190.53.226	192.168.43.227	TCP	54	0.065223000 443 → 54537 [AC
	25 0.2969 35.190.53.226	192.168.43.227	TLSv1.3	1424	0.002728000 Server Hello, Ch
	26 0.2969 35.190.53.226	192.168.43.227	TCP	1424	0.000000000 443 → 54537 [PSH
	27 0.2970 192.168.43.227	35.190.53.226	TCP	54	0.000050000 54537 → 443 [ACK
	28 0.2970 192.168.43.227	35.190.53.226	TCP	54	0.000004000 [TCP Dup ACK 274
	29 0.2971 35.190.53.226	192.168.43.227	TCP	1424	0.000055000 443 → 54537 [AC
	300.297135.190.53.226	192.168.43.227	TLSv1.3	461	0.000000000 Application Data
	31 0.2971 192.168.43.227	35.190.53.226	TCP	54	0.000033000 54537 - 443 [AC
			TCP	54	0.000002000 [TCP Dup ACK 31
	32 0 2971 192 168 43 227	35.190.53.226			
_		35.190.53.226 35.190.53.226	TLSv1.3	134	0.002707000 Change Cipher Sp
	32 0.2971 192.168.43.227				0.002707000 Change Cipher Sp 0.000006000 [TCP Retransmiss 0.02252000 Application Date

Fig. No.18.5. Capture TCP Packets

### To check TCP Header information:

1. Go to display filter => Type "tcp" and press enter

						E3
	me	Source	Destination	Protocol		ince previous frame in this TCP stream Info
		2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.000000000 443 → 54507 [ACK
26	. 0000	2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.000000000 443 → 54507 [ACK
3 6	.0025	2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.002596000 443 → 54507 [ACK
4 6	.0025	2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TCP	74	0.000000000 443 → 54507 [ACK
5 6	. 0877	2404:6800:4009:803::200e	2409:4042:4d34:2bd7:1d20:d400:5dc7:3b0f	TLSv1.2	581	0.085160000 Application Data
		192.168.43.227	35.190.53.226	TCP	66	0.00000000 54537 - 443 [SYN
16 6	. 1414	192.168.43.227	35.190.53.226		66	0.000013000 [TCP Retransmiss
17 6	. 1417	2409:4042:4d34:2bd7:1d20:d40	2404:6800:4009:803::200e	TCP	74	0.053959000 54507 → 443 [ACK
18 6	. 1417	2409:4042:4d34:2bd7:1d20:d40	2404:6800:4009:803::200e		74	0.000010000 [TCP Dup ACK 17#
19 6	. 1847	35.190.53.226	192.168.43.227	TCP	66	0.043325000 443 → 54537 [SYN
20 6	. 1849	192.168.43.227	35.190.53.226	TCP	54	0.000212000 54537 - 443 [ACK
		192.168.43.227	35.190.53.226			0.000010000 [TCP Dup ACK 20#
22 6	. 2290	192.168.43.227	35.190.53.226	TLSv1.3	571	0.044045000 Client Hello (SN
23 6	. 2290	192.168.43.227	35.190.53.226		571	0.000009000 [TCP Retransmiss
24 6	. 2942	35.190.53.226	192.168.43.227	TCP	54	0.065223000 443 → 54537 [ACK
25 6	. 2969	35.190.53.226	192.168.43.227	TLSv1.3	1424	0.002728000 Server Hello, Ch
26 6	. 2969	35.190.53.226	192.168.43.227	TCP	1424	0.000000000 443 → 54537 [PSH
27 6	. 2970	192.168.43.227	35.190.53.226	TCP	54	0.000050000 54537 - 443 [ACK
28 6	. 2970	192.168.43.227	35.190.53.226	TCP	54	0.000004000 [TCP Dup ACK 27#
29 6	. 2971	35.190.53.226	192.168.43.227	TCP	1424	0.000055000 443 → 54537 [ACK
30 6	. 2971	35.190.53.226	192.168.43.227	TLSv1.3	461	0.000000000 Application Data
31 6	. 2971	192.168.43.227	35.190.53.226	TCP	54	0.000033000 54537 → 443 [ACK
32 6	. 2971	192.168.43.227	35.190.53.226	TCP	54	0.000002000 [TCP Dup ACK 31#
33 6	. 2998	192.168.43.227	35,190,53,226	TLSv1.3	134	0.002707000 Change Cipher Sp
34 6	. 2998	192.168.43.227	35.190.53.226	TCP	134	0.000006000 [TCP Retransmiss
35.0	2005	100 160 43 007	25 100 52 226	TI C 1 2	700	A ADD7EDAAA Anniication Data
knowle	dgment	number (raw): 3761192796				
01	. = Hea	ader Length: 20 bytes (5)				
age . P	×018 (1	PSH, ACK)				

Fig.No.18.6.TCP packets

2. Double click on tcp as shown in fig. 18.6. Now TCP Header information will be available as shown in fig. 18.7

Ether	net I	I, S	-c:	ASUST	ekCOMP	U_66	Lts), 74 5:dc:5e 2404:61	(40:b0:	76:66:d	c:5e),	Dst:	00:a	1:a7:3	1:2e:1	F4 (00	ad:a	7:31	:2e:f4	))	1526-B	6BA-37	826EA0	:1440},	id 0	
Trans Sou [St [Co [TC Seq [Ne: Ack dia 010 Fla Win [Ca [Win	missi rce Po tinat: ream : nvers P Segr uence uence vence nowled nowled nowled nowled nowled nowled nowled nowled nowled dow: 0 cloue	on C port: ion F index ation Numb Numb Quenc dgmer dgmer . = F x010 545 ted v size	443 ort: 0 con Len: er: er: (e Nu t Nu t nu leade (ACF	ol Pr 5450 ppleto (raw) umber umber umber ter () ow si: ling	otocol 27 (rela: 3627 : 1 : 1 (raw) ngth: 22: 64	Inc tive 0173 (re (re : 18 20 b 5] : -1	rc Port: omplete sequenc	443, D (12)] e numbe equence ick numb	er) e number	: 54507						201.04		ac7:31	NOT						
Urg ~ [Ti [1 [1	ent Po mestar ime s ime s 00 ac	ointe mps] ince ince	fir pre	st fr vious e f4	frame	thi in 76	is TCP s this TCI 66 dc 5 00 40 0	P strea	im: 0.00	1.	.@.	onds]													
9928	00 00 d4 00	00 5d	00 2 c7 3	0 0e b 0f	24 09	40 d4	42 4d 3 eb 15 9	4 2b d7	7 1d 20		-\$-	@BM4+													

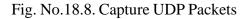


## **Steps to Capture UDP packets**

1.Go to display filter

2. Type "udp" and press enter

1					
	6 0 . 0935 192 . 168 . 43 . 227	192.168.43.19	DNS	Length Time since	Standard query 0x7f5c AAAA beacons.ecp.evt2.com
	7 0.0935 192.168.43.227	192.168.43.19	DNS	80	Standard query 0x7f5c AAAA beacons.gcp.gvt2.com
		192.168.43.19		80	Standard query 0x7t5c AAAA beacons.gcp.gvt2.com Standard query 0x9884 A beacons.gcp.gvt2.com
	8 0.0949 192.168.43.227 9 0.0949 192.168.43.227	192.168.43.19	DNS	80	
	10 0.0961 192.168.43.227	192.168.43.19	DNS	80	Standard query 0x9884 A beacons.gcp.gvt2.com
					Standard query 0x2a36 HTTPS beacons.gcp.gvt2.com
	11 0.0961 192.168.43.227	192.168.43.19	DNS	80	Standard query 0x2a36 HTTPS beacons.gcp.gvt2.com
	120.1182192.168.43.19	192.168.43.227	DNS	193	Standard query response 0x7fSc AAAA beacons.gcp.gvt2.com CNA
	13 0.1397 192.168.43.19	192.168.43.227	DNS	152	Standard query response 0x9884 A beacons.gcp.gvt2.com CNAME
	14 0.1397 192.168.43.19	192.168.43.227	DNS	193	Standard query response 0x2a36 HTTPS beacons.gcp.gvt2.com CN
	48 3.3721 192.168.43.227	192.168.43.19	DNS	89	Standard query 0x977f A v10.events.data.microsoft.com
	49 3.3721 192.168.43.227	192.168.43.19	DNS	89	Standard query 0x977f A v10.events.data.microsoft.com
	50 3.3724 192.168.43.227	192.168.43.19	DNS	89	Standard query 0x6790 AAAA v10.events.data.microsoft.com
	51 3.3724 192.168.43.227	192.168.43.19	DNS	89	Standard query 0x6790 AAAA v10.events.data.microsoft.com
	52 3.4096 192.168.43.227	192.168.43.19	DNS	89	Standard query 0x6790 AAAA v10.events.data.microsoft.com
	53 3.4096 192.168.43.227	192.168.43.19	DNS	89	Standard query 0x977f A v10.events.data.microsoft.com
	54 3.4096 192.168.43.227	192.168.43.19	DNS	89	Standard querv 0x977f A v10.events.data.microsoft.com
her	net II, Src: 00:ad:a7:31:2e: net Protocol Version 4, Src: Datagram Protocol, Src Port: n Name System (query)	f4 (00:ad:a7:31:2e:f4 192.168.43.227, Dst:	), Dst: ASU	STekCOMPU_66	sce \Device\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id 0 S∶dc:5e (40:b0:76:66:dc:5e)



UDP Header information look like fig. no.18.9



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# X Conclusion

#### **XI** Practical related questions

- 1. How to capture TCP and UDP both packet at a time by using Wireshark?
- 2. Compare TCP and UDP
- 3. What is TCP 3-way handshake process? Write the Procedure to capture TCP 3-way handshake process by using Wireshark?
- 4. Write the Applications of TCP and UDP.

#### **Space for Answer**

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# XII References:

https://www.geeksforgeeks.org/tcp-3-way-handshake-process/
 https://youtu.be/AgAE8zkBoHk?si=ekhlrDg8PLn2lx-6
 https://youtu.be/EFxDXA9J-hk?si=Ad7iY82i4xF4Zyg4

## XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# Practical No. 19: Capture ARP and ICMP packet using Wireshark

### I Practical Significance

ARP (Address Resolution Protocol) is one of the most important protocols which is responsible to find the hardware address of a host from a known IP address. ICMP (Internet Control Message Protocol) is used for reporting errors and management queries. Student should be able to capture ARP and ICMP Packet using Wireshark.

# II Industry / Employer Expected Outcome(s)

1. Capture ARP and ICMP packet Traffic using Wireshark

## **III** Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services

# IV Laboratory Learning Outcome(s)

LLO 19.1 Filter ARP and ICMP packet Traffic using Wireshark.

# V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice
- **VI Relevant Theoretical Background :** ARP takes the IP address of a host as input & gives its corresponding physical address as the output. ARP sends the IP broadcast message to all the computer on the network. The computer whose IP address matches the broadcast IP address sends a reply and along with, its physical address to the broadcasting computer. All other computers ignore the broadcast message

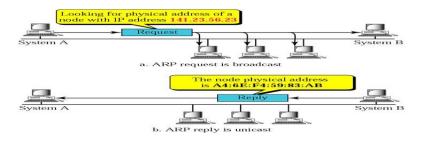


Fig. No . 19.1. ARP

Hardware Type		Protocol Type		
Hardware Length	Protocol Length	Operation Request 1, Reply 2		
	Sender Hardw	vare Address		
	Sender Proto	col Address		
	Target Hardw	are Address		
	Target Proto	col Address		

Fig.No.19.2. ARP Header Format

## ✤ ICMP

The ICMP stands for **Internet Control Message Protocol**. It is a network layer protocol. It is used for error handling in the network layer, and it is primarily used on network devices such as routers. As different types of errors can exist in the network layer, so ICMP can be used to report these errors and to debug those errors. The ICMP protocol requires no handshakes or formal connections. Instead, it operates as a connectionless protocol. And the data you get back is in numeric form. You'll need to decode it to make sense of it.

The ICMP messages are usually divided into two categories: error reporting messages and Query messages

The **error-reporting message** means that the router encounters a problem when it processes an IP packet then it reports a message. Various types of Messages are used under this category like destination unreachable, source quench, Time exceeded, parameter problem and redirection.

The **query messages** are those messages that help the host to get the specific information of another host. For example, suppose there are a client and a server, and the client wants to know whether the server is live or not, then it sends the ICMP message to the server. Various types of Messages are used under this category like echo request or reply and Timestamp request or reply.

Type(8 bit)	Code(8 bit)	CheckSum(16 bit)							
	Extended Header(32 bit)								
	Data/Payload(Variable Length	n)							



#### **Recourses Required:**

- Computer / Networked Computers (with internet connectivity)
- Wireshark Software (Open-source software)

#### VIII Precautions to be followed:

- 1. Handle Computer system and peripherals with care.
- 2. Follow safety Practices

# IX Procedure

VII

#### **Steps to Capture ARP packets**

- 1. Go to display filter
- 2. Type "arp" and press enter

■ <u>1</u> 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	sols Help				
	20.				80
Time Source	Destination	Protocol	Length Time since	e previous f Info	(Westernet
52 5.0873 ASUSTekCOMPU_66:dc:5e	00:ad:a7:31:2e:f4	ARP	42	Who has 192.168.43.227? Tell 192.168.43.19	
53 5.0874 00:ad:a7:31:2e:f4	ASUSTekCOMPU_66:dc:5e	ARP	42	192.168.43.227 is at 00:ad:a7:31:2e:f4	
54 5.087400:ad:a7:31:2e:f4	ASUSTekCOMPU_66:dc:5e	ARP	42	192.168.43.227 is at 00:ad:a7:31:2e:f4	
1 15.564 00:ad:a7:31:2e:f4	Broadcast	ARP	42	Who has 192,168,43,19? Tell 192,168,43,227	
115.56400:ad:a7:31:2e:f4	Broadcast	ARP	42	Who has 192.168.43.19? Tell 192.168.43.227	
1 15.568 ASUSTekCOMPU_66:dc:5e	00:ad:a7:31:2e:f4	ARP	42	192.168.43.19 is at 40:b0:76:66:dc:5e	
2 35.646 ASUSTekCOMPU_66:dc:5e	00:ad:a7:31:2e:f4	ARP	42	Who has 192.168.43.227? Tell 192.168.43.19	
2 35.647 00:ad:a7:31:2e:f4	ASUSTekCOMPU_66:dc:5e	ARP	42	192.168.43.227 is at 00:ad:a7:31:2e:f4	
2 35.647 00:ad:a7:31:2e:f4	ASUSTekCOMPU_66:dc:5e	ARP	42	192.168.43.227 is at 00:ad:a7:31:2e:f4	
1 62.607 ASUSTekCOMPU_66:dc:5e	00:ad:a7:31:2e:f4	ARP	42	Who has 192.168.43.227? Tell 192.168.43.19	
1 62.607 00:ad:a7:31:2e:f4	ASUSTekCOMPU 66:dc:5e	ARP	42	192.168.43.227 is at 00:ad:a7:31:2e:f4	
1_62.607_00:ad:a7:31:2e:f4	ASUSTekCOMPU_66:dc:5e	ARP bits) on in	42 terface \Dev	192.168.43.227 is at 00:ad:a7:31:2e:f4	0
Frame 52: 42 bytes on wire (336 bi Ethernet II, Src: ASUSTekCOMPU_66: iddress Resolution Protocol (reque Hardware type: Ethernet (1) Protocol type: IPv4 (0x8800)	- ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [	bits) on in	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0
rame 52: 42 bytes on wire (336 bi thernet II, Src: ASUSTekCOMPU_66: Address Resolution Protocol (reque Hardware type: Elethernet (1) Protocol type: IPv4 (0x0800) Hardware size: 6	- ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [	bits) on in	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0
rame 52: 42 bytes on wire (336 bi thernet II, Src: ASUSTekCOMPU_66: Uddress Resolution Protocol (reque Hardware type: Ethernet (1) Protocol type: IPv4 (0x0800) Hardware size: 6 Protocol size: 4	- ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [	bits) on in	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0
Frame 52: 42 bytes on wire (336 bi Ethernet II, Src: ASUSTekCOMPU_66: Address Resolution Protocol (reque Hardware type: Ethernet (1) Protocol type: IPv4 (0x0800) Hardware size: 6 Protocol size: 4 Opcode: request (1)	- ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [ st]	bits) on in Ost: 00:ad:a	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0
irame 52: 42 bytes on wire (336 bi ithernet II, Src: ASUSTekCOMPU_66: ddress Resolution Protocol (reque Hardware type: Ethernet (1) Protocol type: IPv4 (0x0800) Hardware size: 6 Protocol size: 4 Opcode: request (1) Sender MAC address: ASUSTekCOMPU,	- ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [ st]	bits) on in Ost: 00:ad:a	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0
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Frame 52: 42 bytes on wire (336 bi Ethernet II, Src: ASUSTekCOMPU_66: Address Resolution Protocol (reque Hardware type: Ethernet (1) Protocol type: IPv4 (0x0800) Hardware size: 6 Protocol size: 4 Opcode: request (1) Sender MAC address: ASUSTekCOMPU,	- ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [ st) 	bits) on in Ost: 00:ad:a	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0
Frame 52: 42 bytes on wire (336 bi Ethernet II, Src: ASUSTekCOMPU_66: Address Resolution Protocol (reque Hardware type: Ethernet (1) Protocol type: IPv4 (0x0800) Hardware size: 6 Protocol size: 4 Opcode: request (1) Sender MAC address: ASUSTekCOMPU Sender IP address: J92.168.43.19	_ ts), 42 bytes captured (336 dc:5e (40:b0:76:66:dc:5e), [ st) 	bits) on in Ost: 00:ad:a	terface \Dev	vice\NPF_{5CF259F9-90AC-4526-B6BA-37826EAC1440}, id	0

Fig. No.19.4. Capture ARP Packets

#### **ARP Request and Reply packets**

- Above Fig.No 19.4. shows ARP packet including request packet as well as reply packet.
- Analysed ARP Request Packet:

Double click on ARP request Packet as shown in fig. 19.4. Now ARP Request packet header information will be available as shown in fig. 19.5 including IP address, MAC address of sender and IP address of Target and other information.

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0010		00	00	00	00	00		uo	20																									

Fig. No.19.5.ARP Broadcast Packet header information

### • Analysed ARP Replay Packet:

Double click on ARP Replay Packet as shown in fig. 19.4. Now ARP Reply packet header information will be available as shown in fig. 19.6 including IP address, MAC address of sender, IP address, MAC Address of Target and other information.

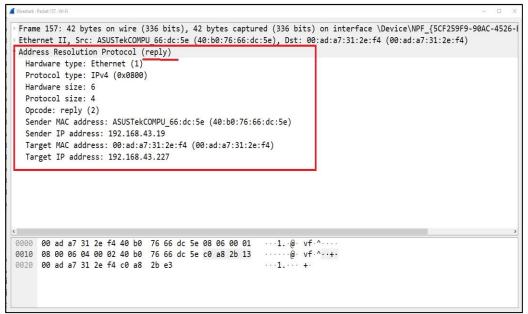


Fig. No.19.6. ARP Reply Packet header information

### **Steps to Capture ICMP packets:**

1. Go to display filter

2. Type "icmp" and press enter

3. Go to command prompt and execute ping command

C:\>ping www.msbte.org.in

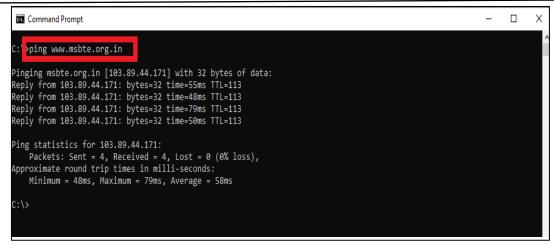


Fig. No.19.7. Ping Command

5. Go to Wireshark. All ICMP packets are captured by Wireshark.

6. Click on ICMP Request Packet as shown in fig. No.19.8. Now ICMP Request packet header information will be available.

			85 - WE - 110	- 1015					83	- •
Time Source	Destination	Pateral T.CMD	Length Ti 74	ALC: NOT THE OWNER OF THE OWNER	(			70/20224	++1 64	1
1154.2192.168.43.227	103.89.44.171	ICMP		the second second				seq=79/20224,		
1 154.2 192.168.43.227	103.89.44.171	ICMP	74				222/01/	seq=79/20224,		100
1154.2 103.89.44.171	192.168.43.227	ICMP	74					seq=79/20224,		
1 155.2 192.168.43.227	103.89.44.171	ICMP	74					seq=80/20480,		
1 155.2 192.168.43.227	103.89.44.171	ICMP	74			and the second second		seq=80/20480,		
1 155.2 103.89.44.171	192.168.43.227	ICMP	74			reply		seq=80/20480,		1.1
1 156.2 192.168.43.227	103.89.44.171	ICMP	74					seq=81/20736,		100
1156.2 192.168.43.227	103.89.44.171	ICMP	74					seq=81/20736,		
1156.3 103.89.44.171	192.168.43.227	ICMP	74	Echo	(ping)	reply	id=0x0001,	seq=81/20736,	ttl=113	3 (1
1 157.2 192.168.43.227	103.89.44.171	ICMP	74	Echo	(ping)	request	id=0x0001,	seq=82/20992,	ttl=64	(no
1 157.2 192.168.43.227	103.89.44.171	ICMP	74	Echo	(ping)	request	id=0x0001,	seq=82/20992,	ttl=64	(re
										. 1.
Ethernet II, Src: 00:ad:a7:31			74 COMPU_6			reply 0:76:66:c		seq=82/20992,	ttl=113	s (
Ethernet II, Src: 00:ad:a7:31 [Internet Protocol Version 4. [Internet Control Message Protot Type: 8 (Echo (ping) request Code: 0 Checksum: 0x440c [correct] [Checksum Status: Good] Identifier (BE): 1 (0x0001) Identifier (LE): 256 (0x0106	:2e:f4 (00:ad:a7:31:2e:f4 Src: 192.168.43.227, Dst: ocol t)	), Dst: ASUSTek						seq=82/20992,	ttl=113	5 (1
thernet II, Src: 00:ad:a7:31 internet Protocol Version 4. internet Control Message Prot Type: 8 (Echo (ping) request Code: 0 Checksum: 0x4d0c [correct] [Checksum Status: Good] Identifier (BE): 1 (0x0001) Identifier (LE): 256 (0x0106 Sequence Number (BE): 79 (0)	:2e:f4 (00:ad:a7:31:2e:f4 Src: 192.168.43.227, Dst: ocol :) 3) x004f)	), Dst: ASUSTek						seq=82/20992,	tt1=113	\$ (
<pre>ithernet II, Src: 00:ad:a7:31 internet Protocol Version 4. internet Control Message Prot Type: 8 (Echo (ping) request Code: 0 Checksum: 0x4d0c [correct] [Checksum: 0x4d0c [correct] Identifier (BE): 1 (0x0001) Identifier (LE): 256 (0x0106 Sequence Number (LE): 20224</pre>	:2e:f4 (00:ad:a7:31:2e:f4 Src: 192.168.43.227, Dst: ocol :) 3) x004f)	), Dst: ASUSTek						seq=82/20992,	tt1=113	\$ (
Code: 0 Checksum: 0x4d0c [correct] [Checksum Status: Good] Identifier (BE): 1 (0x0001) Identifier (LE): 256 (0x0106 Sequence Number (BE): 79 (0)	:2e:f4 (00:ad:a7:31:2e:f4 Src: 192.168.43.227, Dst: ocol :) 3) x004f)	), Dst: ASUSTek						seq=82/20992,	tt1=113	
Ethernet II, Src: 00:ad:a7:31 Internet Protocol Version 4. Internet Control Message Prot Type: 8 (Echo (ping) request Code: 0 Checksum: 0x4d0c [correct] [Checksum Status: Good] Identifier (BE): 1 (0x0001) Identifier (LE): 256 (0x0106 Sequence Number (BE): 79 (0)	:2e:f4 (00:ad:a7:31:2e:f4 Src: 192.168.43.227, Dst: ocol :) 3) x004f)	), Dst: ASUSTek						seq=82/20992,	tt1=11:	5

Fig. No.19.8. ICMP Request packet header information

7. Click on ICMP Reply Packet as shown in fig. No.19.9. Now ICMP Reply packet header information will be available.

Mefi								~ 0 >
File Edit View Ge Capture Analyse Statistics Telephony Wirden T <b>4</b> = 2 • 3 • 3 × 5 • 9 + • • • • • • • • • • • • • • • • •								
	<u>u</u>							
No. Time Source	Destination	Protocol	Length Tir	me: Info				
1 154.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=79/20224,	ttl=64 (no
→ 1154.2 192.168.43.227	103.89.44.171	TCMP	74	Echo (ping)	request	id=0x0001,	seq=79/20224,	ttl=64 (re
1 154.2 103.89.44.171	192.168.43.227	ICMP	74	Echo (ping)	reply	id=0x0001,	seq=79/20224,	ttl=113 (r
1 155.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=80/20480,	ttl=64 (no
1 155.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=80/20480,	ttl=64 (re
1 155.2 103.89.44.171	192.168.43.227	ICMP	74	Echo (ping)	reply	id=0x0001,	seq=80/20480,	ttl=113 (r
1 156.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=81/20736,	ttl=64 (no
1 156.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=81/20736,	ttl=64 (re
1 156.3 103.89.44.171	192.168.43.227	ICMP	74	Echo (ping)	reply	id=0x0001,	seq=81/20736,	ttl=113 (r
1 157.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=82/20992,	ttl=64 (no
1157.2 192.168.43.227	103.89.44.171	ICMP	74	Echo (ping)	request	id=0x0001,	seq=82/20992,	ttl=64 (re
L 1 157.3 103.89.44.171	192.168.43.227	ICMP	74	Echo (ping)	reply	id=0x0001,	seq=82/20992,	ttl=113 (r
Ethernet II, Src: ASUSTekCOMPU_ Internet Protocol Version 4, Sm Internet Control Message Protoci Type: 0 (Echo (ping) reply) Code: 0 Checksum: 0x550c [correct] [Checksum Status: Good] Identifier (BE): 1 (0x0001) Identifier (BE): 256 (0x0100) Sequence Number (BE): 79 (0x00 Sequence Number (LE): 20224 (0 [Request frame: 11597]	c: 103.89.44.171, Dst: 1		1:47:3	1:20:14 (00:2	0:37:31:2	/e:t4)		
[Response time: 55.235 ms]								

#### Fig. No.19.9. ICMP Reply packet header information

# X Conclusion

#### **XI** Practical related questions

- 1. What is the use of ARP?
- 2. Write down steps to check ARP Request and ARP Reply packet format by using Wireshark.
- 3. What is the size of an ARP request and ARP Reply packet?
- 4. At which layer do ICMP works?
- 5. What are the various ICMP Messages.

#### **Space for Answer**

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Maharashtra State Board of Technical Education ( 'K' Scheme)

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- 1. https://www.geeksforgeeks.org/how-address-resolution-protocol-arp-works/
- 2. https://www.hackers-arise.com/post/network-basics-for-hackers-address-resolution-protocol-or-arp
- 3. https://www.youtube.com/watch?v=BEUrxiiD7\_w&list=PLTS-Jel4E3gX2tNXyXVImwdW2NaV-dR6U&index=4
- 4. https://www.youtube.com/watch?v=rEtp2Cgkpno&t=7s

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

Practical No. 20: Install Operating System Linux/Windows/Any other Server 2019

# I Practical Significance

Student should be able to install windows server 2019 Operating system

# II Industry / Employer Expected Outcome(s)

- 1. Understand working of Windows 2019 server.
- 2. Compare the server based/ Network operation system with Desktop Operating System.

# III Course Level Learning Outcomes(s)

CO1 - Analyze the functioning of Data Communication and Computer Network.

# IV Laboratory Learning Outcome(s)

LLO 20.1 Install server operating system

# V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

### Network Operating System

An Operating system, which includes software and associated protocols to communicate with other autonomous computers via a network conveniently and cost-effectively, is called Network Operating System. It allows devices like a disk, printers, etc., shared between computers. The individual machines that are part of the Network have their operating system and the Network Operating System resides on the top of the individual machines.

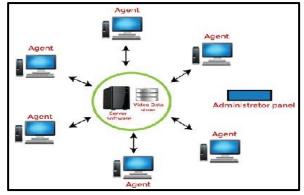


Fig.No. 20.1. Network Operating System

#### **\*** Windows server 2019 Edition

Windows Server 2019 is for the time being the latest version of the server operating system released by Microsoft. Generally available since October 2018, Windows Server 2019 is built on the strong foundation of Microsoft's previous release, Windows Server 2016. The functionality of the 2019 release offers new opportunities when it comes to hybrid cloud environments, storage, security, and administration. Additionally, Windows Server 2019 comes with a user-friendly interface and comprehensive documentation, making it suitable for students who are new to server administration.

Windows Server 2019 has three editions: Essentials, Standard, and Datacenter. As their names imply, they are designed for organizations of different sizes, and with different virtualization and datacenter requirements. Windows Server 2019 Essentials perfectly suits the needs of a small infrastructure, while the Datacenter edition provides the widest range of functions among all the other server operating systems from Microsoft.

# VII Recourses Required:

Processor – 1.4 GHz 64-bit processor

- RAM 512 MB
- Disk Space 32 GB
- Network Gigabit (10/100/1000 based) Ethernet adapter
- Optical Storage DVD drive (if installing the operating system from DVD media)
- Video Super VGA (1024 x 768) or higher -resolution
- Input Devices Keyboard and mouse
- Internet Broadband access

# VIII Precautions to be followed:

Selection of any drive for installation must be done carefully so as not to delete any useful data

# IX Procedure: Installation steps for Network operating system windows server 2019

- 1. BOOT your Computer System from OS Media
- 2. When the Computer Starts, press any key if you asked for you like to BOOT from the disc by pressing any key
- 3. On the first screen, select installation language, Time and keyboard layout the click "Next"

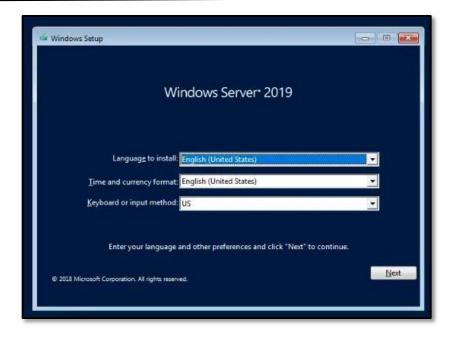


Fig.No.20.2. Select Language, Time and keyboard layout

4. Start the installation by clicking on "Install Now"

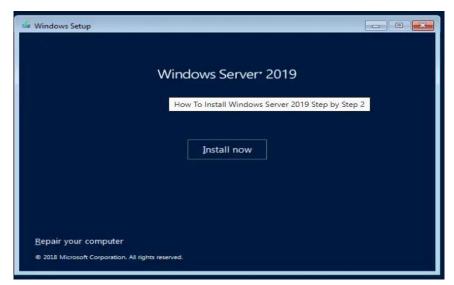


Fig.No. 20.3. Click on Install Now

5. Select the Windows Server 2019 edition to install and click "Next"

Operating system	Architecture	Date modified
Windows Server 2019 Standard Evaluation	х64	1/8/2019
Windows Server 2019 Standard Evaluation (Desktop Experien	x64	1/8/2019
Windows Server 2019 Datacenter Evaluation	x64	1/8/2019
Windows Server 2019 Datacenter Evaluation (Desktop Experi	x64	1/8/2019
Description: This option installs the full Windows graphical environment, cor		rive space. It can b
reful if you want to use the Windows desktop or have an ann t		
iseful if you want to use the Windows desktop or have an app t		
iseful if you want to use the Windows desktop or have an app t		
seful if you want to use the Windows desktop or have an app t		

Fig. No .20.4. Selection of Windows Server 2019

6. Read the License terms and agree to them to start the installation by checking the box "I accept the license terms "

IMPORTANT NOTI	CE (followed by LICENSE TERMS)	1
information, which r	age Information. Microsoft automatically collects this may be associated with your organization, over the	I
internet, and uses it	to help improve yo How To Install Windows Server 2019 Step by S quality and security or microsort products and services.	itep
	entials has four (4) information collection settings	
	anced, and Full), and uses the "Enhanced" setting by	
	ed level includes information required to: (i) run our	
	agnostic and usage information technologies; (ii) quality, and application usage and compatibility; and (iii)	
	es in the use and performance of the operating system	
		~

Fig. No. 20.5. Notices And License Terms

7. if this is the first installation of Windows Server 2019 on the server, select custom installation only

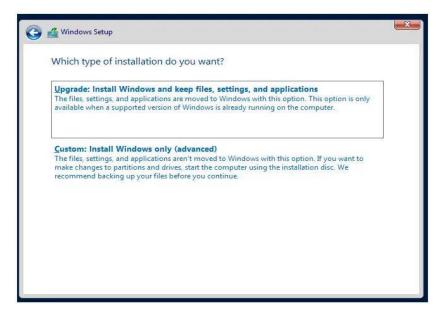


Fig. No .20.6. Selection of type of installation

8. Select a partition to install Windows Server, you can optionally create new one from available or use total available size by clicking "**Next**".

		Total size	Free space	Туре
Drive	0 Unallocated Space	50.0 GB	50.0 GB	

Fig.No. 20.7. Select drive

9. The installation should start, wait for it to finish.



Fig.No.20.8. Installing Windows

10. The system should automatically reboot after the installation. Set Administrator password when prompted on the next screen.

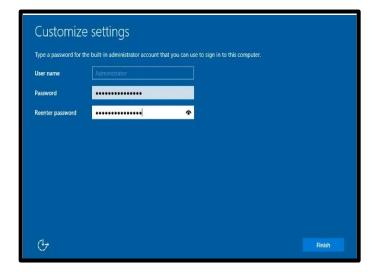


Fig.No. 20.9. Assign Username and Password to account

11. Click Finish to complete the installation. To login with the Administrator user, use

Ctrl+Alt+Del key combination.

12. Provide your Administrator Password and hit Enter



Fig.No. 20.10. Administrator Login

13. Access to Server Manager **Local Server** section should also give you some details about Windows Server 2019 installation.

Setting	15		
ŵ	Home	About	
Fine	a setting رو ا	Device spec	ifications
Syste	m	Device name	WIN-5RD9TVT8VDE
		Processor	Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz 1.80 GHz
<b>P</b> 1	Display	Installed RAM	2.00 GB
		Device ID	3870884E-AD73-4399-86D1-FD289E4F4F76
<b>4</b> 0) :	Sound	Product ID	00430-00000-00000-AA768
		System type	64-bit operating system, x64-based processor
	Notifications & actions	Pen and touch	No pen or touch input is available for this display.
2	Focus assist	Rename this P	c
© I	Power & sleep		
	Battery	Windows sp	pecifications
	Storage	Edition	Windows Server 2019 Datacenter
		Version	1809
13	Tablet mode	Installed on	2/10/2019
		OS build	17763.1
Ħi ۱	Multitasking	Change product	key or upgrade your edition of Windows

Fig. No. 20.11. Setting of server manager Local server

# X Conclusion

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### XI Practical related questions

- 1. What is main purpose to use server?
- 2. How much editions are available in windows server 2019?
- 3. List down advantage of Windows server 2019
- 4. Compare the features of different Network Operating Systems
- 5. Explain types of Installation of windows server

#### **Space for Answer**

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#### XII References:

- 1. How To Install Windows Server 2019 Step by Step | ComputingForGeeks
- 2. Windows Server 2019 | Microsoft Evaluation Center
- 3. windows server 2019 versions list Search (bing.com)

### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

# Practical No. 21: Use FTP protocol to transfer file from one system to another system

### I Practical Significance

In any organization, it is required to share files and resources as it simplifies the access to these resources from anywhere. It also reduces the cost of equipment as they are shared among multiple users. By sharing files, it reduces the storage cost. The student will be able to share files using File transfer protocol

# II Industry / Employer Expected Outcome(s)

- 1. Able to Set up FTP client server
- 2. Able transfer files using FTP

### III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services.

### IV Laboratory Learning Outcome(s)

LLO 21.1 Create FTP Server

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

### VI Relevant Theoretical Background

The file transfer protocol (FTP) is a standard network protocol used to transfer computer files between a client and server on a computer network. FTP is a client-server protocol and it relies on two communication channels between the client and the server.

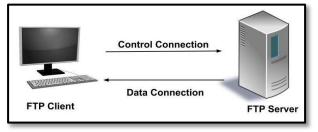


Fig No. 21.1.FTP

- 1. **Control Connection:** The FTP client sends a connection request usually to server port number 21. This is the control connection. It is used for sending and receiving commands and responses.
- **2. Data Connection:** For transferring the files and folder we use a separate connection called data connection.

In order to reach an FTP server, a connection through an FTP client first needs to be established. This FTP client creates a TCP connection to the control port of the server (normally port 21) and is then able to send commands that the server subsequently answers. Following this, the data is transferred through another port. At this point, it\_s important to differentiate between two **different types of transfer modes**. In active mode, the client, which uses port 1023, signals its IP address through port 21 during connection buildup. This process informs the server which port the client can be reached on. In passive mode, the server does not receive an IP address from the client (due to a firewall, for example) and offers the client a port through which a connection can be established.

There are many FTP programs currently available on the market like Cyberduck, FileZilla, FireFTP, Fresh FTP, SmartFTP, WinSCP, WISE-FTP.

# VII Recourses Required:

- Computer (Standard Specifications with internet connection)
- Filezilla software (Open-Source Software) or any other relevant software

# VIII Precautions to be followed:

1. Handle Computer system and network devices with care.

2. Follow safety Practices

## IX Procedure

Filezilla is a powerful tool and a free software for transferring files over the internet

<b>E</b> Fil	
there is a second s	
Home FileZilla Features Screenshots Documentation	The Best FTP Solution
FileZilla Pro	Overview
ileZilla Server	Welcome to the homepage of FileZilla@, the free FTP solution. The FileZilla Client not only supports FTP, but also FTP over TLS (FTPS) and SFTP. It is open
ommunity	source software distributed free of charge under the terms of the GNU General Public License.
Forum Wiki	We are also offering FileZilla Pro, with additional protocol support for WebDAV, Amazon S3, Backblaze B2, Dropbox, Microsoft OneDrive, Google Drive, Microsoft Azure Blob and File Storage, and Google Cloud Storage.
eneral	Last but not least, FileZilla Server is a free open source FTP and FTPS Server.
FAQ Support	Support is available through our forums, the wiki and the bug and feature request trackers.
Contact License	In addition, you will find documentation on how to compile FileZilla and nightly builds for multiple platforms in the development section.
Privacy Policy Trademark Policy	♦ Quick download links
Development Source code Nightly builds Translations Version history Changelog Issue tracker	Download FileZilla Client Al deforma       Download FileZilla Server Al deforma         Pick the client if you want to transfer lies. Get the server if you want to make files available for others.
Other projects	💊 News 🛄
libfilezilla	

#### Procedure to use Filezilla to transfer files

1. download and activate FileZilla client software on your computer.

Fz FileZilla											. 0 X
File Edit Vie		ver Bookmarks Help									
표 - I 💽 🕯											
Host:	Userr	name:	Password:	Port:	Quickconnec						
											^
Local site: C:\l					•	Remote site:					
e- <b>4</b>	Users				^						
	B Admin				=						
0 C 0 E	e :				-						
Filename		Filesize Filetype	Last modified			Filename	Filesize Filetype	Last modified	Permissions	Owner/Group	
<u>.</u>											
							Not	onnected to any se	ver		
Empty directory						Not connected.					
Server/Local file		Direction Remote file		Size Priority Status							
Queued files	Failed transfers	Successful transfers	1								
4		1								Queue: empty	
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Fig No.21.3. FileZilla client software

2. Enter domain name in the **Host** field or one can use the account's IP address. The **username** and the **password** that has to be entered are the same as that which used to log in. The **FTP port** is 21. Then, to connect, press the **Quickconnect** button.



Fig No.21.4. enter details to connect to hosting account

**3.** The user will get connected to hosting account and on the right side of the FTP client window a list of all the files and folders on your account will be displayed.

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Fig No.21.5. left panel (local PC) and Right Panel (server files)

**4.** From the right panel of the FTP client navigate to the folder on the account in which the new files are to be uploaded

**5.** Then, select one or more files from the left side panel (from the computer from which files are to be transferred) to be uploaded and right click on them. From the menu that shows up, click the **Upload** button.

Add files to queue Open Edit	Constant .	
	Add files to qu	Heure
Edit	Open	
	Edit	
Create directory		
Create directory and enter Refresh		and enter it
	Delete	
Delete	Rectarum	

Fig No.21.6. Upload Files

**6.** The transfer will automatically be initiated, which will be indicated at the bottom panel of the application.

7. Wait for the upload to complete, after which the uploading of these files will be logged in the **Successful Transfers** tab at the bottom panel.

Conclusion

Х

### XI Practical related questions

- 1. What is FTP?
- 2. Draw a diagram for FTP
- 3. Which Port numbers are used for FTP?
- 4. How does an FTP client connect to an FTP server?
- 5. What's the difference between active and passive mode in FTP?

#### **Space for Answer**

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### XII References:

- 1. https://afteracademy.com/blog/what-is-ftp-and-how-does-an-ftp-work/
- 2. https://www.cloudwards.net/what-is-ftp/
- 3. <u>https://youtu.be/\_9NWIkrMIp4?si=MCXtzM-tV54W49iB</u>

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 22: Create IPv6 environment in a small network using simulator

### I Practical Significance

Student Should Create IPv6 environment in s small network Using Simulator

# II Industry / Employer Expected Outcome(s)

- 1. To study IPV6 concepts.
- 2. To set network using a simulator

### III Course Level Learning Outcomes(s)

CO4 - Configure different TCP/IP services.

# IV Laboratory Learning Outcome(s)

LLO 22.1 Implement IPv6 addressing scheme on a network.

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

### VI Relevant Theoretical Background Proposition 1: IPV6 Addressing

IPv6 was developed by Internet Engineering Task Force (IETF) to deal with the problem of IPv4 exhaustion. IPV6 stand for Internet Protocol Version 6. IPv6 is a 128-bits address having an address space of  $2^{128}$ , which is way bigger than IPv4. IPv6 use Hexa-Decimal format separated by colon (:).

Components in Address format:

- 1. There are 8 groups and each group represents 2 Bytes (16-bits).
- 2. Each Hex-Digit is of 4 bits (1 nibble)
- 3. Delimiter used colon (:)

Data is transmitted to many computers via the internet using the Internet Protocol (IP). There will be at least one IP address assigned to each network interface or computer on the internet, which is used to identify that computer uniquely. An IP address is given to each computer or other device that connects to the internet. Because of this, the IETF developed the new IPv6 standard in response to concerns over the IP address capacity of IPv4.

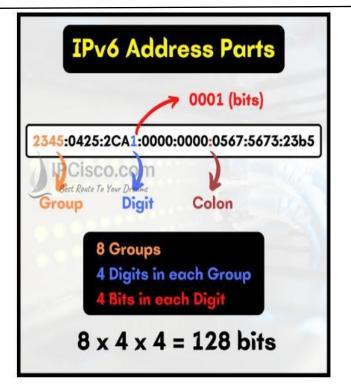


Fig.No. 22.1. Representation of IPv6 Address

IPv6 is supported by operating systems (OSes) such as Windows 10, macOS, and Ubuntu. Presently, different address types are used. As of now, devices use IPv6 or IPv4. Since 2008, domain name systems have supported IPv6.

# VII Recourses Required:

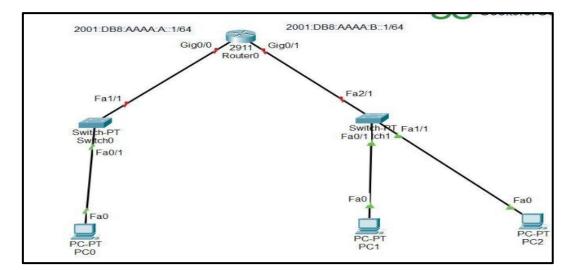
- Any desktop or laptop computer with basic configuration
- CISCO Packet Simulator.

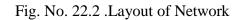
# VIII Precautions to be followed:

- **1.** Handle equipment with care
- 2. Follow safety Practices

# IX Procedure

- 1. Install CISCO Packet Tracer simulator on your computer system
- **2.** First open the Cisco packet tracer on desktop and create a network topology like below figure and an IPv6 addressing given below table.





S.NO	Device Name	Model-Name	Link-Local-Address	Default- Gateway
1.	PC	PC	FE80::207:ECFF:FEA3:EB56	FE80::1
2.	Switch	PT-switch	FE80::207:ECFF:FEB9:862A	FE80::1
з.	Router	2911	FE80::250:FFF:FE6C:B21	FE80::1
4.	cable	Automatic connecting cable	nil	nil

S.NO	Interface	IPv6 Address
1.	Gig0/0	2001:DB:AAAA:A::1/64
2.	Gig0/1	2001:DB:AAAA:B::1/64

Fig.No. 22.4 IP addresses of interface

- 3. Configuring the GigabitEthernet Interfaces.
- 4. First, we will configure the GigabitEthernet0/0 using CLI.
- 5. Click on **router0** and go to CLI and type the commands are given below:

```
Router>en
Router*conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ipv6 unicast-routing
Router(config)#int Gig0/0
Router(config-if)#ipv6 address FE80::1 link
Router(config-if)#ipv6 address FE80::1 link-local
Router(config-if)#no shut
```

Fig.No.22.4. Configuration of GigabitEthernet0/0

- Now we will configure the **GigabitEthernet0/1** Interface.
- Click on **router0** and go to CLI and type the commands are given below:

```
Router(config-if)#int Gig0/1
Router(config-if)#ipv6 address FE80::1 link-local
Router(config-if)#no shut
```

Fig.No. 22.5. Configuration of GigabitEthernet0/1

- Then, both the interfaces will be active now
- 3. Configuring Ipv6 address in both Interfaces using CLI:
- CLI commands to configure IPv6 address in GigabitEthernet0/0 and GigabitEthernet0/1 ports are given below:

```
Router#en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int Gig0/0
Router(config-if)#ipv6 address 2001:DB8:AAAA:A::1/64
Router(config-if)#no shut
Router(config-if)#int Gig0/1
Router(config-if)#ipv6 address 2001:DB8:AAAA:B::1/64
Router(config-if)#ipv6 address 2001:DB8:AAAA:B::1/64
Router(config-if)#no shut
Router(config-if)#
```

Fig.No.22.6 .Configure IPv6 Address to Ipv6

Router0		U	8
Physical Config CLI Attributes			
IOS Command Line	Interface		
Router(config-1f)#int Gig0/1			
Router(config-if)#ipv6 address FE80:	:1 link-local		
Router(config-if)#no shut			
Router(config-if)#			
<pre>%LINK-5-CHANGED: Interface GigabitEt</pre>	hernet0/1, change	d state	
to up			
%LINEPROTO-5-UPDOWN: Line protocol c	n Interface		
GigabitEthernet0/1, changed state to			
Router(config-if)#exit			
Router (config) #exit			
Router#			
%SYS-5-CONFIG_I: Configured from con	sole by console		
Router#en			
Router#conf t			
Enter configuration commands, one pe	r line. End with	CNTL/Z.	
Router(config)#int Gig0/0			
Router(config-if)#ipv6 address 2001:	DB8:AAAA:A::1/64		
Router(config-if)#no shut			
Router(config-if)#int Gig0/1			
Router(config-if)#ipv6 address 2001:	DB8:AAAA:B::1/64		
Router(config-if) #no shut			
Router(config-if)#			
Ctrl+F6 to exit CLI focus	Сору	Paste	

Fig.No. 22.6. IOS Command line Interface

- 4. We have configured the router now change the settings of hosts in IPv6 configuration:
- First, click on PC0 and go to desktop then IP configuration.
- Now find the IPv6 configuration.
- Change the settings from static to automatic and then after a few seconds, the IPv6 address and default gateway are displayed.

Physical Config De	sktop Programming	Attributes			
IP Configuration					х
Interface FastEth IP Configuration	ernet0				~
	O Static				
IPv4 Address					
Subnet Mask					
Default Gateway	0.0.0.0				
DNS Server	0.0.0.0				
IPv6 Configuration					
Automatic	◯ Static	lpv6 r	equest succe	essful.	
IPv6 Address	001:DB8:AAAA.A.	207 ECFF:FE/	3.EB56 /	64	
Link Local Address	FE80::207:ECFF:	EA3:EB56			
Default Gateway	FE80::1				
DNS Server					
802.1X					
Use 802.1X Securit	у				
Authentication	MD5				

Fig.No. 22.7. Configure PC0

• Similarly, repeat this procedure with PC1 and PC2

PC1	- D X	Physical Config Des	iktop Programming Attributes
Physical Config De	sktop Programming Attributes	Physical Coning Des	
IP Configuration	X	Interface FastEthe	ernet0 v
Interface FastEth		IP Configuration	
IP Configuration		O DHCP	O Static
O DHCP	Static	IPv4 Address	
IPv4 Address		Subnet Mask	
Subnet Mask		Default Gateway	0.0.0
Default Gateway	0.0.0.0	DNS Server	0000
DNS Server	0000	IPv6 Configuration	
IPv6 Configuration		<ul> <li>Automatic</li> </ul>	Static Ipv6 request successful.
Automatic	Static Ipv6 request successful.	IPv6 Address	2001:D88:AAAA:B:250:FFF:FE6C:B21 / 64
IPv6 Address	001 DB8 AAAA B 207 ECFF FEB9 862A / 64	Link Local Address	FE80::250:FFF:FE6C:B21
Link Local Address	FE80::207.ECFF.FEB9:862A	Default Gateway	FE80_1
Default Gateway	FE80::1	DNS Server	
DNS Server		802.1X	
802.1X		Use 802.1X Security	1
Use 802.1X Securit	ly .	Authentication	MD5 V
Authentication	MD5		

Fig.No.22.8 .Configure PC1, PC2

- 5. Now we have to verify the connection by pinging the IPv6 address of PC0 in PC1.
- First, click on PC1 and go to the command prompt, and type ping <ipv6 address>

#### Command: ping 2001:DB8:AAAA:A:20D:BDFF:FE1A:D121

• As we can see in the below image, getting replies from PC0 means the connection is established successfully.

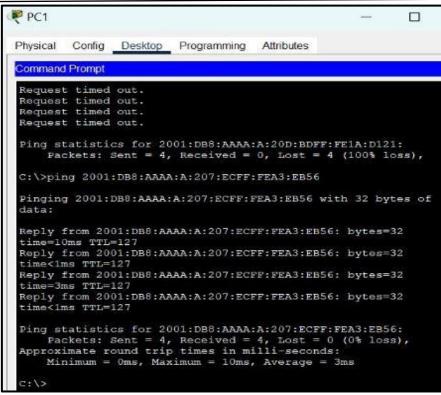


Fig.No. 22.8 .Connection Established Successfully

## X Conclusion

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#### XI Practical related questions

- 1. Write a difference Between IPv4 and IPv6
- 2. Explain Features of IPv6.
- 3. How IPv6 is represent (notification if IPV6 explain with example.
- 4. Explain TPV6 Header Format

#### **Space for Answer**

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#### XII References:

- 1. How to Configure IPv6 on CISCO Router? GeeksforGeeks
- 2. What is IPv6: Important Features and Uses (spiceworks.com)

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 23: \*Create HTTP server

### I Practical Significance

The HTTP Server provides many security features that help you control access to data and files. Performance in a Web server environment is influenced by many components. student should crate HTTP server

# II Industry / Employer Expected Outcome(s)

- 1. Understand the concept of HTTP Server
- 2. Implement HTTP Server

### III Course Level Learning Outcomes(s)

CO5 - Implement relevant Network Topology using Networking Devices.

# IV Laboratory Learning Outcome(s)

LLO 23.1 Configure HTTP server on given operating system.

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

#### **Relevant Theoretical Background**

#### HTTP server

VI

In computing, a server is a computer program or a device that provides functionality for other programs or devices, called clients. The functionalities, or services, that a server can provide are multiple and go from sharing data or resource among multiple clients to performing computation for client. The web server or HTTP server is a server software (or hardware dedicated to running a server software) that implements the request/response model using the World Wide Web and the HTTP (protocol.) The HTTP server processes incoming network requests from the clients over the HTTP protocol and serves contents over the internet.

The HTTP or **Hypertext Transfer Protocol** is an application layer protocol that is used to virtually transmit files and other data on the World Wide Web, whether they're HTML files, image files, query results, or anything else.

In simpler words,

The HTTP is a universally-spoken language with a simple grammar that "translates" the communication between the client and the server by specifying how the information must be requested and how the responses are formed. Usually, HTTP is based on the TCP/IP protocols so it takes place through TCP/IP sockets.

### working of HTTP Server

The primary function of the HTTP server is to store, process and deliver web pages to clients using the Hypertext Transfer Protocol. A client, or better said a user agent which is a software acting on behalf of a user (commonly represented by a web browser), initiates communication by making a request for a specific resource using HTTP to the server, an application running on a computer hosting a website.

The server, which provides resources such as HTML files and other content, or performs other functions on behalf of the client, returns a response message to the client. The response served by the server contains completion status information about the request and may also contain requested content in its message body, or an error message if it is unable to serve the content. The primary function of the HTTP server is to serve content, its implementation can also include ways of receiving content from clients. This feature is used for example for submitting web forms, including uploading of files. The HTTP server can generate HTML documents dynamically (on-the-fly) as opposed to returning documents statically. Or it could merge and serve both. These decisions are made based on configuration options and programs written in languages like PHP.

# VII Recourses Required:

1. Network Computer system

2. Microsoft Internet Information Services (IIS) web server software package

# VIII Precautions to be followed:

- **1.** Handle equipment with care
- **2.** Follow safety Practices

# IX Procedure:

### Install an Apache HTTP Server:

### Step 1:

Navigate to Apache Website - (httpd.apache.org)

- 1. Click on "*Download*" link for the latest stable version
- 2. After being redirect to the download page, Select: "Files for Microsoft Windows"
- 3. Select one of the websites that provide binary distribution (for example: *Apache Lounge*)
- 4. After being redirect to "<u>Apache Lounge</u>" website (<u>https://www.apachelounge.com/download</u>/), Select: Apache x.x.xx Win64 link

After downloaded, unzip the file httpd-x.x.xx-Win64-VC15.zip into C:/

#### Step 2:

- 1. Open a command prompt: Run as Administrator
- 2. Navigate to directory c:/Apache24/bin
- 3. Add Apache as a Windows Service: httpd.exe -k install -n "Apache HTTP Server"
- 4. In the event of the following error follow **Step 3** otherwise jump to **Step 4**: "*The program can't start because VCRUNTIME140.dll is missing from your computer. Try reinstalling the program to fix this problem*"
- 5. If after configuring Apache as a Windows service it fails to start and reports this error "Windows could not start the Apache HTTP Server on Local Computer." It is likely that Apache is not able to use the default port (normally 80) because another process is using the same port. Open an administrative command prompt and issue the command "netstat -anbo".
- 6. If another process is using the port which Apache is configured to listen on, modify the Listen port in the httpd.conf file of the Apache installation to use a port that is not already taken by another process. Or alter the process holding the port to use a different port so Apache can listen on this port.

#### Step 3:

- 1. At Apache Lounge website, check the section "*Apache 2.4 VC15 Windows Binaries and Modules*" on the main page
- Download the file from the link vc\_redist\_x64 (I.e <u>https://aka.ms/vs/15/release/VC\_redist.x64.exe</u>)
- 3. Install Visual C++ 2017 files
- 4. Repeat Step 2

#### Step 4:

- 1. Open Windows Services and start Apache HTTP Server
- 2. Open a Web browser and type the machine IP in the address bar and hit Enter
- 3. The message "It works!" should be seen.

# X Conclusion

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Pra	actical related questions
1. I	Explain Working of Web Server
2. 1	Explain application of HTTP server
3.1	Explain Working of HTTP server
	Space for Answer
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#### XII References:

- 1. How to install Apache HTTP Server on Windows Server? Progress Community
- 2. <u>http-server npm (npmjs.com)</u>
- 3. What is a web server Working and Architecture GeeksforGeeks

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 24: \*Connect computers using Star topology with wired media

### I Practical Significance

A Star topology is a type of network topology in which all the devices or nodes are physically connected to a central node such as a router, switch, or hub. Student should be able to connect computers of laboratory in star topology using transmission media and network control devices.

# II Industry / Employer Expected Outcome(s)

1. Understand concept of topology and its type.

2. Able to create Local area Network using star topology.

### **III** Course Level Learning Outcomes(s)

CO5 - Implement relevant Network Topology using Networking Devices.

### IV Laboratory Learning Outcome(s)

LLO 24.1 Use star topology for a given situation.

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

### VI Relevant Theoretical Background

Network Topology refers to layout of a network. How different nodes in a network are connected to each other and how they communicate is determined by the network's topology.

#### **Types of Topologies**

Following are different types of topologies which mainly used to connect computers with each other to form a network.

- 1. Bus Topology
- 2. Ring Topology
- 3. Star Topology
- 4. Mesh Topology
- 5. Tree Topology
- 6. Hybrid Topology

#### ✤ Star Topology

In this type of topology all the computers are connected to a single hub/switch through a cable. This hub/switch is the central node and all others nodes are connected to the central node. Every node has its own dedicated connection to the hub/switch. Hub/switch acts as a repeater for data flow

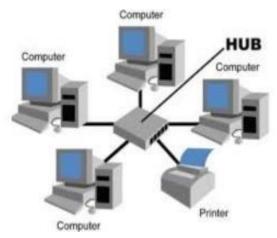


Fig:24.1. Star Topology

#### Advantages of Star Topology

- 1. Fast performance with few nodes and low network traffic.
- 2. Easy to troubleshoot.
- 3. Easy to setup and modify.
- 4. Only that node is affected which has failed, rest of the nodes can work smoothly.

### **Disadvantages of Star Topology**

1. If the hub/switch fails then the whole network is stopped because all the nodes depend on the hub.

# VII Recourses Required:

- Computers with updated configuration
- Switch/Hub
- Wired Transmission Media and Connector

# VIII Precautions to be followed:

- 1. Handle Computer system and network devices with care.
- 2. Follow safety Practices

# IX Procedure

Teacher shall explain structure, advantage and disadvantage of each topology.

#### Procedure to create star topology:

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- 1. Power on the computers that want to connect in star topology and confirm whether operating system and NIC card is properly worked.
- 2. Power on the central device i.e. switch or hub.
- **3.** Take cable and connect one end of one cable to port of the switch or hub and connect the other end of the same cable to computer's NIC port.
- 4. The lights on port of the switch or hub.
- 5. This is the physical formation of star topology.
- **6.** Check workgroup of computer or write name of workgroup under which all computers are connected to each other.

#### Set Up and Join a Workgroup in Windows 10

- Navigate to Control Panel, System and Security and System to access your computer details.
- Find Workgroup and select Change settings.
- Click on Change Button to 'To rename computer name or workgroup '.
- Type name of the computer and name of the Workgroup that you want to join and click on OK.

System Properties         23           Computer Name         Hardware         Advanced         System Protection         Remote           Windows uses the following information to identify your computer on the network.         Windows uses the following information to identify your computer	Computer Name/Domain Changes
Computer description: For example: "Kitchen Computer" or "Mary's Computer".	Computer name: APL-13
Full computer name: APL-13 Workgroup: IT-1	Full computer name: APL-13
To use a wizard to join a domain or workgroup, click Network ID To rename this computer, click Change. Change	Member of Domain:
OK Cancel Apply	© Workgroup: IT-1 OK Cancel

Fig 24.2. Set Up and Join A Workgroup

- 7. Assign IP address to computers using TCP/IP configuration.
  - Click Start menu => control panel => Network and Internet => network and sharing center.
  - Click on "Change Adapter Settings". Right Click on "Local Area Connection" and then click on Properties

🕜 💬 🕫 « All Control Pan	el Items → Network and Sharing Center + 49 Search Control Panel P	
See also HomeSroup Internet Options Windows Frewall	et kens > Network and Staring Center • • • • • Secon Control Form / P View your basic network information and set up connections III.LEU-0-PC (This computer) View your active network III.LEU-0-PC (This computer) View your active network Network Network Network Network Network Network Network Network Network Network Network Network Network Network Network Network Network Network Connections User Journation Network Connections Set up a new connection Change your networking setting: Connection and buildy, at hoc, or VPN connection; or set up is noter or access point. Connect to a network Connect on a network Connect on a network Connect on a network Connect to a network Connect to a network Connect to a network Connect on a network Connect on a network Connect on a network Connect to a network Connect on a network Connect to a network Connect on a network Connect to a network Connect to a network Connect on a network Connect on a network Connect to a network Connect on	Image: Second state of the second s

Fig 24.3 Local Area Connection and open its properties

- Then double click Internet Protocol Version 4 (TCP/IPv4).
- Select "Use the Following IP address": and type in the IP address, Subnet mask and Default gateway.
- Click OK to apply the settings.

etworking	Internet Protocol Version 4 (TCP/	
Connect using:	General	
Realtek RTL8168D/8111D Family PCI-E Gigabit Ethemet		d automatically if your network supports leed to ask your network administrator
This connection uses the following items:	Obtain an IP address autor	natically
Client for Microsoft Networks	Use the following IP addres	ss:
Npcap Packet Driver (NPCAP)	IP address:	192.168.50.93
✓ ■ QoS Packet Scheduler ✓ ■ File and Printer Sharing for Microsoft Networks	Subnet mask:	255.255.0.0
Internet Protocol Version 6 (TCP/IPv6)      Internet Protocol Version 4 (TCP/IPv4)	Default gateway:	192.168.50.1
<ul> <li>✓ → Link-Layer Topology Discovery Mapper I/O Driver</li> <li>✓ → Link-Layer Topology Discovery Responder</li> </ul>	Obtain DNS server address	automatically
Install Uninstall Properties	<ul> <li>Ouse the following DNS served</li> </ul>	er addresses:
Install Uninstall Properties	Preferred DNS server:	8.8.8.8
Transmission Control Protocol/Internet Protocol. The default	Alternate DNS server:	
wide area network protocol that provides communication across diverse interconnected networks.	Validate settings upon exit	Advanced
OK Cancel		OK Cancel

Fig 24.4. Assign IP address

**8.** Repeat the step no.6 and 7 on each computer that want to connect in star topology **Note:** 

- 1. The computers connected to switch or Hub must come under same workgroup.
- 2. IP address of each computer must be unique.

- Use ping command to check whether computer connected in network.
- Once whole network is formed, then go to Network and check whether All computers are connected in network or not.

## X Conclusion

#### XI Practical related questions

- 1. What is Network topology?
- 2. List Different types of Network topology?
- 3. Draw the Network Layout of your Laboratory.
- 4. State advantages and disadvantages of star topology.
- 5. List out names of Wired transmission media and network devices required to form star topology.
- 6. Compare Bus, Ring and Star topology.

#### **Space for Answer**

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#### XII References:

- 1. https://www.geeksforgeeks.org/advantages-and-disadvantages-of-star-topology/
- 2. <u>https://www.youtube.com/watch?v=NSHj9BLnhj0</u>
- XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Effective Practical Implementation with Specified time:40%	
2.	Effective Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
б.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 25: Create Tree topology using CISCO packet tracer software

#### I Practical Significance

Student should Create Tree Topology Network using CISCO packet Tracer Software

# II Industry / Employer Expected Outcome(s)

- 1. Understand the Concept of Tree Topology
- 2. Understand how devices are connected in tree topology using CISCO Packet Tracer

### **III** Course Level Learning Outcomes(s)

CO5 - Implement relevant Network Topology using Networking Devices.

## IV Laboratory Learning Outcome(s)

LLO 25.1 Use Network simulator CISCO packet tracer.

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

## VI Relevant Theoretical Background

### ✤ Tree Topology

In the tree topology of networking, the elements and devices are arranged like a tree structure and have branches of connections between the devices connected to each other. In a such type of topology, there is one central node and each node is connected to the central node through a single path. Nodes can be thought of as branches coming off of the trunk. Tree topologies are often used to create large networks.

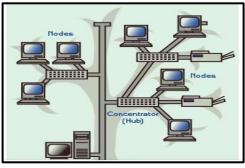


Fig.No. 25.1 Tree Topology

### \* CISCO Packet Tracer

Cisco Packet Tracer is a comprehensive, networking technology teaching and learning program that offers a unique combination of realistic simulation and visualization experiences, assessment and activity authoring capabilities, and opportunities for multiuser collaboration and competition.

# VII Recourses Required:

- Desktop or laptop computer with basic configuration
- CISCO Packet Tracer Software

# VIII Precautions to be followed:

- **1.** Handle equipment with care
- 2. Follow safety Practices

# IX Procedure: Create Tree Topology using CISCO Packet Tracer

- 1. Open the Cisco packet tracer desktop and select the devices given below:
  - Personal Computer (PC)
  - Switch
- 2. Configure Each Device or assign IP address to device

S.NO	Device	IPv4 Address	Subnet Mask
1.	pc0	192.168.0.1	255.255.255.0
2.	pc1	192.168.0.2	255.255.255.0
3.	pc2	192.168.0.3	255.255.255.0
4.	pc3	192.168.0.4	255.255.255.0
5.	pc4	192.168.0.5	255.255.255.0
6.	pc5	192.168.0.6	255.255.255.0

Fig.No. 25.2. Configuration of IP address

- 3. Then, create a network topology as shown below the image.
- 4. Use an Automatic connecting cable to connect the devices with others.

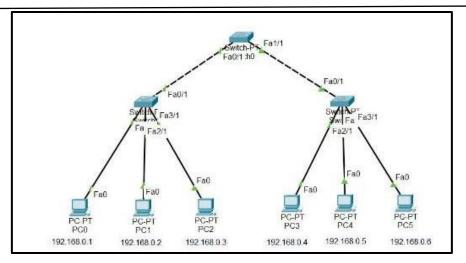


Fig.No. 25.3. Tree Topology Layout

- 5. Configure the PCs (hosts) with IPv4 address and Subnet Mask according to the IP addressing table given above.
- To assign an IP address in PC0, click on PC0.
- Then, go to desktop and then IP configuration and there you will IPv4 configuration.
- Fill IPv4 address and subnet mask

PC0		- 1	o x
esical Config Des	Rtop Programming Attributes		
Configuration			X
entace FastEthe Configuration	metű		100
DHCP	O State		
Pv4 Address	192 168 0 1		_
idoret Masik	255,256,266,0		_
elaut Cateway	0000		
ING Server	0.0.0.0		_
Vit Configuration			_
C Automatic	O Static		
Pv8 Addross		(16)	
ink Local Address	TE80:201 SAFE FE9A:E108		
Infault Gateway			
INS Server			_
02.1X			
Use 802 1X Security	x		
uthentication	M05		
Tap		200	ksforGeeks

Fig.No. 25.4. IPV4 Configuration

- Assigning an IP address using the ipconfig command, or we can also assign an IP address with the help of a command.
- Go to the command terminal of the PC.
- Then, type ipconfig <IPv4 address><subnet mask><default gateway>(if needed)
- For Example: ipconfig 192.168.0.1 255.255.255.0

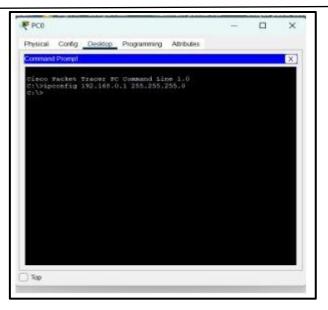


Fig.No. 25.5. Ipconfig command

- Repeat the same procedure with other PCs to configure them thoroughly.
- 6. Verify the connection by pinging the IP address of any host in PC0.
- Use the ping command to verify the connection.
- We will check if we are getting any replies or not.
- As we can see, we are getting replies from a targeted node on both PCs.
- Hence the connection is verified.
- ping <targeted node's IP address>
- 7. A simulation of the experiment is given below we have sent two PDU packets one targeted from PC0 to PC3 and another targeted from PC1 to PC5

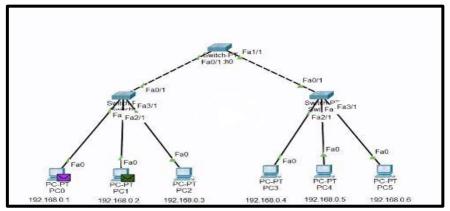


Fig.No. 25.6 Simulation Window

X	Conclusion
	••••••
VI	
XI	Practical related questions
	1. Define Topology and Enlist types of Topologies.
	2. Explain Tree Topology with Neat Diagram.
	3. Explain Use of CISCO Packet Tracer simulator.
	4. Write Difference Between Star and Tree Topology
	Space for Answer
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- 2. AI&ML scholarship student Vani Agarwal | Amazon Web Services (youtube.com)

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 26: Configure TELNET for remote login

### I Practical Significance

Telnet short for "teletype network" is a client/server application protocol that provides access to virtual terminals of remote systems on local area networks or the Internet. Student should be able to configure TELNET for remote login.

# II Industry / Employer Expected Outcome(s)

- 1. To gain knowledge about TELNET
- 2. To understand configuration of TELNET for remote login

### III Course Level Learning Outcomes(s)

CO5 - Implement relevant Network Topology using Networking Devices.

# IV Laboratory Learning Outcome(s)

LLO 26.1 Implement remote login feature.

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

#### ✤ TELNET

TELNET stands for Teletype Network. It is a type of protocol that enables one computer to connect to the local computer. It is used as a standard TCP/IP protocol for virtual terminal service which is provided by ISO. The computer which starts the connection is known as the local computer. The computer which is being connected to i.e. which accepts the connection known as the remote computer. During telnet operation, whatever is being performed on the remote computer will be displayed by the local computer. Telnet operates on a client/server principle. The local computer uses a telnet client program and the remote computers use a telnet server program.

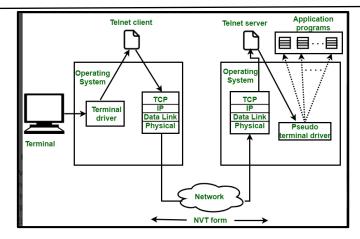


Fig.No. 26.1 Remote Login in Logging

### **Types of Logins**

In TELNET, there are the following types of logins:

### Local Login

This type of login occurs whenever a person logs into the local computer. The terminal driver accepts keystrokes that are entered by user when workstation is running a terminal emulator. Here, the terminal driver forwards these characters to the operating system that launches the required application software.

### **Remote Login**

The user primarily transmits the keystroke to terminal driver, where the operating system only receives but does not understand characters. These characters are then transferred to client that converts these characters into Network Virtual Terminal (NVT) characters.

After conversion, the client converts them and sends them back to TCP/IP stack. The text in NVT form travels via the internet till it reaches TCP/IP protocol stack on a distant system. The erver converts these NVT characters into characters that remote machines can understand.

# VII Recourses Required:

Latest configuration Computer System

# VIII Precautions to be followed:

- **1.** Handle equipment with care
- **2.** Follow safety Practices

# IX Procedure: Connect to remote Login / Server with the help of Telnet

Telnet is a command line tool that is designed for administering remote servers through the Command Prompt. Unlike earlier versions of Windows, Windows (and its predecessors) does not come with the Telnet client installed. You will need to activate it before you can start using it.

- Open the Control Panel and go to "Programs and Features" > "Turn Windows features on or off". Enter your Administrator password if prompted.
- Find the "Telnet Client" entry in the list of available features and check the box next to it. Then, click OK.
- To use telnet, open Command Prompt, type telnet, and press Enter

1. **Open Control Panel.** By default, Telnet is not installed with Windows. It will need to be manually activated in order for you to use it. You can do so through the Control Panel; you'll find in the Start menu.



Fig.No. 26.2. How to active TELNET

2. **Open Programs and Features or Programs.** The option available to you will depend on whether your Control Panel is in Icon or Category view, but they both take you to the same place.

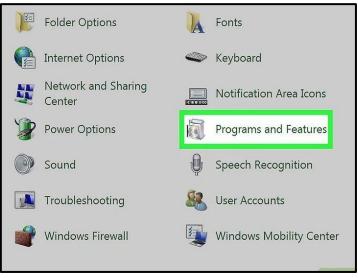


Fig.No. 26.3. Select Programs and Features

3. Click Turn Windows features on or off. You may be asked for the Administrator password.



Fig 26.4. Turn Features on or off

4. Check the box next to "Telnet Client" and click OK. You may have to scroll down to find it. This installs and activates telnet.

• You may have to wait a minute or two for the client to be installed after selecting it.

### Install Telnet through the command prompt (optional)

If you'd rather do everything through the Command Prompt, you can install Telnet with a quick command. First, open the Command Prompt by typing cmd into the Run box and pressing Enter. At the prompt, type pkgmgr /iu:"TelnetClient" and press Enter. After a moment, you will be returned to the command prompt.

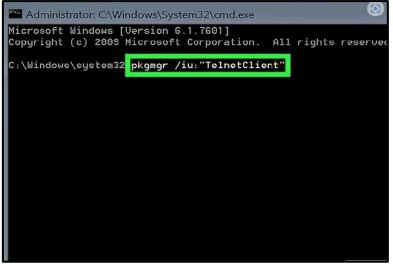


Fig.No. 26.5 Install Telnet with Command prompt

1. Open the Command Prompt. Telnet runs through the Command Prompt. You can access the command prompt by pressing Win, typing cmd, and clicking OK.

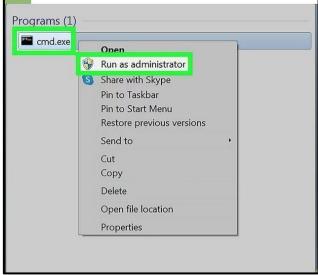


Fig.No. 26.6. Open CMD

2. Start the telnet client. Type telnet and press Enter. The Command Prompt will disappear, and you will be taken to the Telnet command line, displayed as Microsoft Telnet.

Administrator: C:\Windows\System32\cmd.exe		3
Microsoft Windows [Version 6.1.7601] Copyright (c) 2009 Microsoft Corporation.	A11	rights
C:\Windows\system32 <mark>telnet</mark> ,		

Fig.No.26.7. Connect to Server

3. Connect to a server. At the Telnet command lin type open serveraddress [port]. For some servers, you will not need to enter a port—telnet will default to port 23, the default TCP port for telnet servers. You have successfully connected to the server when you receive either a welcome message or are prompted for your username and password

- For example, to watch ASCII Star Wars, type open towel.blinkenlights.nl and press **Enter**.
- You can also start a connection directly from the Command Prompt by typing telnet serveraddress [port]



Fig.No. 26.8. Disconnect to Server with remote login

4. Close your Telnet session. Once you are finished, you should close your connection before closing the window. To do so, press Ctrl +], type quit, and then press Enter.

## X Conclusion

.....

### XI Practical related questions

- 1. Explain Use of TELNET
- 2. Explain Two types of logins use in TELNET
- 3. Explain which Command Use for to active TELNET

#### **Space for Answer**

Maharashtra State Board of Technical Education ( 'K' Scheme)

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- 1. How to Activate Telnet in Windows 7 (w/ Pictures) (wikihow.com)
- 2. <u>Starting a Telnet client session Τεκμηρίωση IBM</u>

#### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 27: \*Visit your computer laboratory i) Identify the type of topology

ii) Identify types of connecting devices with specifications iii) Identify types of cables with specifications iv) List the type of network applications commonly used in the laboratory iv) Draw the layout of installed network

### I Practical Significance

This practical will enable the student to identify the various networking devices available in the lab and the way they are connected in the network.

### II Industry / Employer Expected Outcome(s)

- 1. Understand the type of Topology
- 2. Identify types of cable with its specification
- 3. Understand and identify the network devices

```
III Course Level Learning Outcomes(s)
```

CO5 - Implement relevant Network Topology using Networking Devices.

## IV Laboratory Learning Outcome(s)

LLO 27.1 Survey existing network infrastructure

### V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical practice

# VI Relevant Theoretical Background

• Network Topology: Topology defines the structure of the network of how all the components are interconnected to each other.

Types of Topologies:

- 1) Bus Topology
- 2) Star Topology
- 3) Ring Topology
- 4) Mesh Topology
- 5) Tree Topology
- 6) Hybrid Topology

### ✤ Network device

Network devices, also known as networking hardware, are physical devices that allow hardware on a computer network to communicate and interact with one another. For example, Repeater, Hub, Bridge, Switch, Routers, Gateway, and NIC, etc.

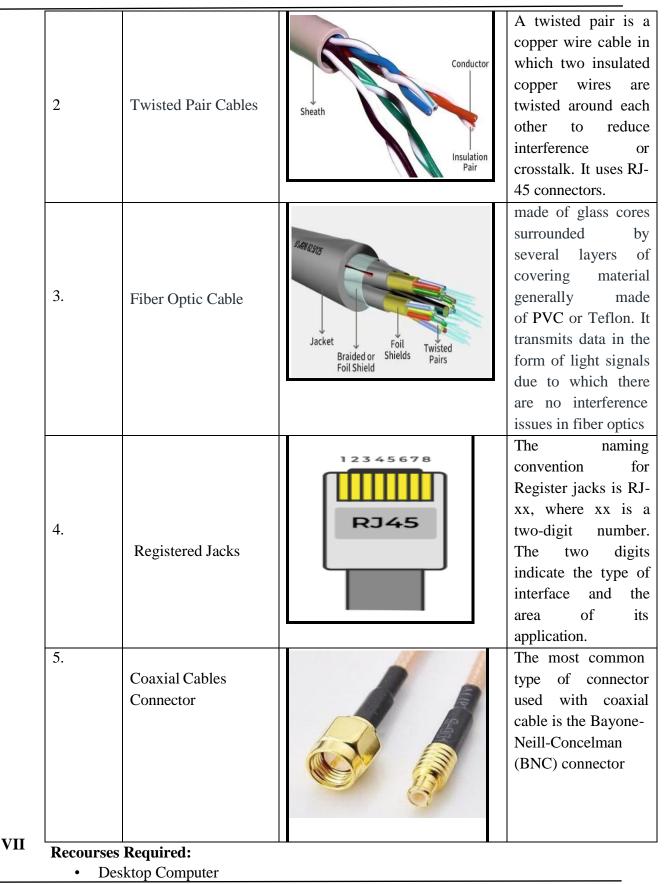
SR No	Device Name	Figure	Use
1.	Repeater	and the second sec	A repeater strengthens a signal and resends it to its destination.
2.	Hub		A hub is a physical device used to join multiple devices on the same LAN
3.	Switch		A network switch forwards data to its destination by examining an incoming frame's MAC address
4.	Router		Routersexamineincoming packets todetermineappropriatedestinationdPaddressand thenforward the packet tothat destination.
5.	Gateway		A gateway is a network node that connects discrete networks or systems that use different protocols, enabling data to flow between the networks.

6.	Bridge		A network bridge
0.	Blidge		-
			acts as an
			interconnection
			between two or more
			LANs, essentially
			creating a single
			domain from
			separate LANs.
7.	Network Interface		A circuit board
	card		installed on the
			computer to connect
			to the network. It
		A A A A A A A A A A A A A A A A A A A	works as an
		and a	indispensable
			component for the
			network connection

### Cable and Connector

Cable allows the user to connect their devices such as computers, mobile phones, routers, etc, to a Local Area Network (LAN) that will allow a user to have internet access, and able to communicate with each other through a wired connection. It also carries broadband signals between devices connected through it. In this article, we are going to discuss different types of Ethernet cable used in local area networks for reliable internet connection.

Sr No	Cable and Connector Name	Figure	Use
1	Coaxial Cable	Outside Copper Insulation Mesh Insulator RG 59 Copper Wire	A coaxial cable is used to carry high- frequency electrical signals with low losses. It has a copper conductor in the middle that is surrounded by a dielectric insulator g enerally made of PVC or Teflon



- Networking Devices (Hub, Switch, Router, Repeater, NIC)
- Connecting Cable and Connectors

# VIII Precautions to be followed:

- **1.** Handle equipment with care
- 2. Follow safety Practices

# IX Procedure

- 1. Identify network Topology use in your network lab
- 2. Identify Various Network devices available in lab
- 3. Observed standard specification on different cable and connector
- 4. Observed the type of cable use in out lab
- 5. Check the speed of data in your Lab
- 6. Observed your network lab and write observations in bellow table

Sr No	Part	Manufacturer	Specification
1	Network Device		
2	Type of Cable		
3.	Connector used		
4	Type of Topology used		

Draw the layout of installed network:

X	Conclusion
	••••••
	••••••
XI	Practical related questions
	1 Define Tendlery
	1. Define Topology
	2. Explain use of network device
	3. Enlist the type of network applications commonly used in the laboratory
	4. Explain types of cable use in network laboratory
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- 2. <u>Network Topology Diagrams and Selection Best Practices for 2022 (spiceworks.com)</u>
- 3. Understanding the Eight Different Network Devices (netwrix.com)
- 4. <u>LAN Network Cable Media and Connectors | LAN Network Cable Media and</u> Connectors | Pearson IT Certification

### XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	

### Practical No. 28: Share folder and printer in a network

### I Practical Significance

Student will learn how to share a printer and folder in network.

## II Industry / Employer Expected Outcome(s)

- 1. Understand use of resource sharing.
- 2. Understand use of printer and folders in network.

### III Course Level Learning Outcomes(s)

CO1 - Analyze the functioning of Data Communication and Computer Network.

### IV Laboratory Learning Outcome(s)

LLO 28.1 Transfer a file from one computer to another.

LLO 28.2 Print documents from remote system in a network.

## V Relevant Affective Domain related Outcomes

- Follow safely Measures
- Follow ethical Practice

## VI Relevant Theoretical Background

#### Resources in Computer network

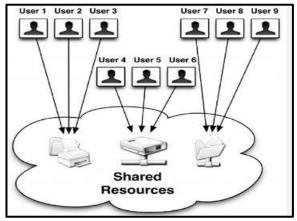
A resource is any hardware or software accessible by a computer, network, or another object connected to a computer. For example, a printer connected to a network is an example of a shared resource. Another example of a resource may be a network server farm or cluster that allows users to access multiple computers to perform complicated tasks. It is a device or piece of information on a computer that can be remotely accessed from another computer transparently as if it were a resource in the local machine. Network sharing is made possible by inter-process communication over the network

#### **\*** Resource Shearing:

In computing, a shared resource, or network share, is a computer resource made available from one host to other hosts on a computer network it is a device or piece of information on a computer that can be remotely accessed from another computer typically via a local area network or an enterprises Intranet. Example are shared file access also known as disk sharing or folder sharing; shared printer access is known as printer sharing. Shared scanner access, etc. Resource sharing means reduction in hardware costs.

Shared files mean reduction in memory requirement, which indirectly means reduction in file storage expense

A network share can become a security liability when access to the shared files is gained (often by devious means) by those who should not have access to them. many computer worms have

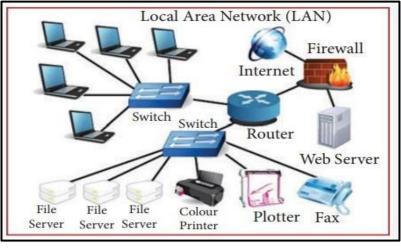


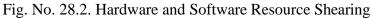


#### **Proposition 3: Hardware Resource and Software resource shearing**

There are two types of resource sharing: Hardware Resource and Software Resource

Hardware Resource shearing: Sharing of Printer, Scanner, fax machines in a network Software Resource Shearing: include files, network connections and memory shearing





#### Printer and folder shearing

Printer sharing is feature which allows you to access and use a printer from other computers in network. If there are employees in an organization, each having their own computer, they will require ten printers if they want to use the resource at the same time. Printer sharing allows accessing the computers that can be interconnected using a network, and just one printer can efficiently provide the services to all ten users.

Folder sharing is the public or private sharing of computer data or space in a network with various levels of access privilege. A user sitting at one computer that is connected to network can easily files present on another computers, provided he is authorized to do so. This saves him/her the hassle of carrying a storage device every time data needs to be transported form one system to another system.

### VII Recourses Required:

- 1. Networked Computer
- 2. Printer

# VIII Precautions to be followed:

- 1. Handle Computer system carefully
- 2. Follow safety Practices

## IX Procedure: Share a printer in network

Note: The printer driver is installed and that the printer can print on the primary computer (the computer to which it is connected). Also, ensure that ALL the computers are connected to the same network or router.

- 1. Press the Windows + I key to launch Settings.
- 2. Select Bluetooth & devices on the left and then click Printers & scanners on the right.

		Blue	Bluetooth & devices				
Find a setting	٩	*	Bluetooth Discoverable as	On			
System			Devices	-			
Bluetooth & devices			Mouse, keyboard, pen, audio, displays and docks, other devices	Add device	>		
<ul> <li>Network &amp; internet</li> </ul>		9	Printers & scanners				
/ Personalization		6	Preferences, troubleshoot		~		
Apps Apps	1		Your Phone	Open Your Phone			
Accounts		U	Instantly access your Android device's photos, texts, and more	Open Your Phone	>		
Time & language		6	Cameras				

Fig.No. 28.3. Select Printer and scanner option

3. Identify the printer you want to share, then, select it.

			··· > Printers & scanners	
Find	a setting	Q	Add a printer or scanner	Add device
-	System		🖀 Fax	>
0	Bluetooth & devices			
•	Network & internet		🚍 HP Deskjet 5679	>
1	Personalization			
	Apps		Microsoft Print to PDF	>
:	Accounts			
3	Time & language		Microsoft XPS Document Writer	>

Fig.No 28.4.Identify name of Printer

4. Select Printer Properties from the available option.

Fin	d a setting	Printer status: Idle	Nermore
	System	Printer Properties Windows 11	
0 1	Bluetooth & devices	Printer settings	
•	Network & internet	Open print queue	Ø
1	Personalization		
*	Apps	Print test page	ß
•	Accounts		
3	Time & language	Run the troubleshooter	Ø
0	Gaming	Printer properties	C
×	Accessibility	rinter properties	U

Fig.No. 28.5. Properties of Printer

5. At the Sharing tab, select Change Sharing Options.

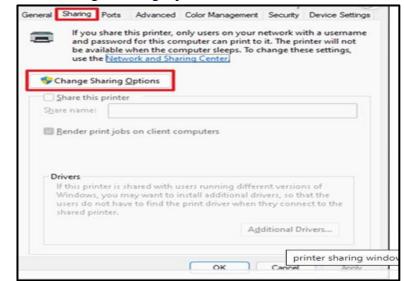


Fig.No. 28.6. Sharing Option

- 6. In printer sharing options
- a. Check the box next to Share this printer.
- b. Type a Share name that other computers will see when they want to connect to the printer.
- **c.** When done, click Apply, then OK.

#### Procedure: Share a folder in network

- 1. Open File Explorer
- 2. Navigate to the folder you want to share
- 3. Right-click the folder and select the Properties option
- 4. Click the Sharing tab
- 5. Click the Advanced Sharing button.

Network File and Folder Sharing ShareOne Not Shared Network Path: Not Shared ShareJ Share Advanced Sharing Set oution permissions, create multiple shares, and set other advanced sharing options. Cadvanced Sharing Password Protection People must have a user account and password for this computer to access shared folders. To change this setting, use the Network and Sharing Center.		Sharing	Security	Previous Versions	Customize
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Fig.No. 28.7. Select Sharing Tap

7. Check the Share this folder option

ettings			
Share name ShareOne2			_
Add	Remove		
Comments:	nber of simultaneou	5 05015 00.	20 🖨
Permissio	ns <u>C</u> aching		

Fig.No.28.8. Advanced Sharing Properties

8. Click the Permissions button

9. Select the Everyone object if you want to share the folder to everyone or Add button to select specific users or group of users

10. Tick the permission boxes to assign users the permission to either read or read and write in the shared folder.

Group or user names:		
	Add	<u>R</u> emove
<u>Permissions for Everyone</u> Full Control Change Read	Allow	

Fig.No. 28.8. Select Permission

11. Select Apply and then OK buttons.

12. Click OK to see the list of shared folders on your computer, see below:

💻   🔜 =   192.168.1.101				- 0	×
File Home Share	View				
Pin to Quick Copy Paste	Move to - X Delete -	New folder	Properties	Select all	
Clipboard	Organise	New	Open	Select	
🕂 🚽 = 🛧 💻 > Netwo	rk > 192.168.1.101 >		v Č Sea	rch 192.168.1.101	P
Google Drive * ^ DARE_Launch_p Green2021	Kyocera KM-2560 KX		Left Metad	ata_video	
Manuais	Paper Archive Images		Users		
<ul> <li>OneDrive</li> </ul>					
This PC					
3D Objects					100 (80)

Fig.No. 28.9. Shared folder

## X Conclusion

..... ..... ..... XI **Practical related questions** 1. How to check is a printer or folder shared in a network. 2. Which are features of computer network? 3. Define resource sharing and state its needs. 4. Give advantages and disadvantages of folder sharing. 5. Enlist the different network devices use in laboratory. **Space for Answer** ..... ..... .....

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- XII References:
  - 1. <u>Manual\_CM4I\_DCC\_22414\_120421.pdfCyclic Redundancy Code (CRC) in C -</u> <u>Naukri Code 360</u>
  - 2. How to Share Printer with Other Computers in Windows 11. WinTips.org
- XIII Assessment Scheme (25 Marks)

S. No.	Weightage- Process related: 60%	Marks-15
1.	Practical Implementation with Specified time:40%	
2.	Handling of Network components:10%	
3.	Follow Ethical Practices:10%	
	Weightage- Product related: 40%	Marks-10
4.	Correctness of Practical:15%	
5.	Timely Submission:15%	
6.	Answer to Sample questions:10%	
	Total 25	
	Dated Signature of Course Teacher	