CMR College of Engineering & Technology
Kandlakoya (V), Medchal Road, Hyderabad - 501 401. Andhra Pradesh. INDIA
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CONTENTS

COMPUTER NETWORKS

Course Objectives:

The objective of the course is to equip the students with a general overview of the concepts

- and fundamentals of computer networks. Familiarize the students with the standard models for the layered approach to communication
- between machines in a network and the protocols of the various layers.

Course Outcomes:

Gain the knowledge of the basic computer network technology.

- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model
- Obtain the skills of subnetting and routing mechanisms
- Familiarity with the essential protocols of computer networks, and how they can be applied in
- network design and implementation.

COMPUTER NETWORKS

Syllabus:

UNIT – I

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet. Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

UNIT - II

Data link layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols. Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT - IV

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT - V

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

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Kandlakoya, Medchal Road, Hyderabad – 501401.

ACADEMIC CALENDAR

Date: 24.06.2023

B.Tech III Year - Academic Year 2023-2024

I Semester

S.No.	Description	Period	Duration
1	Commencement of Class Work	21.08.2023	--------
2	First Spell of Instructions	21.08.2023 to 14.10.2023	8 Weeks
3	*First Mid Examinations*	*16.10.2023 to 21.10.2023*	1 Week
4	Dusara Vacation*	*23.10.2023to 28.10.2023*	1 Week
5	Submission of Mid-I Marks to Exam Branch	30.10.2023	
6	Parent-Teacher Meeting	04.11.2023	
7	Second Spell of Instructions	30.10.2023 to 23.12.2023	8 Weeks
8	*Second Mid Examinations*	*25.12.2023 to 30.12.2023*	1 Week
9	Submission of Mid-II Marks to Exam Branch	06.01.2024	
10	Preparations and Practical Examinations	01.01.2024 to 06.01.2024	1 Week
11	*End Semester & Supplementary Examinations*	*08.01.2024 to 20.01.2024*	2 Weeks

II Semester

S.No	Description	Period	Duration
1	Commencement of Class Work	22.01.2024	--------
2	First Spell of Instructions	22.01.2024 to 16.03.2024	8 Weeks
3	*First Mid Examinations*	*18.03.2024 to 23.03.2024*	1 Week
4	Submission of Mid-I Marks to Exam Branch	30.03.2024	
5	Parent-Teacher Meeting	06.04.2024	
6	Second Spell of Instructions	25.03.2024 to 18.05.2024	8 Weeks
7	*Second Mid Examinations*	*20.05.2024 to 25.05.2024*	1 Week
8	Submission of Mid-II Marks to Exam Branch	01.06.2024	
9	Preparations and Practical examinations	27.05.2024 to 01.06.2024	1 Week
10	*End Semester & Supplementary Examinations*	*03.06.2024 to 15.06.2024*	*2 Weeks*
11	*Summer vacation*	*17.06.2024 to 29.06.2024*	*2 Weeks*
12	Commencement of Class Work for the next A.Y 2024-2025	01.07.2024	

*Dusara Vacation (Subjected to declaration by JNTUH & TS Govt.)

24/6/2023

Principal
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PRINCIPAL

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CMR College of Engineering & Technology

Department of Computer Science & Engineering

SESSION PLANNER

Academic Year: 2022-2023 **R-18**

Semester : V **Sub Code:** A30514

Subject : COMPUTER NETWORK

S.No	Subject Topic Name/ Sub Topic Name	Books	No. of Periods	Cumulative No. of Periods	Delivery Method (Black Board/, PPT/Video ...etc)
	UNIT-I				
1	**Introduction:** Network hardware	T1,R1	1	1	PPT,WB,NPTEL
2	Network software	T1,R1	1	2	PPT,YouTube,NPTEL
3	OSI	T1,R2	2	4	PPT,WB
4	TCP/IP Reference models, Example Networks: ARPANET, Internet	T1,R1	2	5	PPT,WB,YouTube
5	**Physical Layer**: Guided Transmission media: twisted pairs	T1	1	7	PPT,WB,YouTube
6	coaxial cable, fiber optics	T1	1	8	PPT,WB
7	Wireless transmission	T1	1	9	PPT,WB
	UNIT-II				
8	**Data link layer:**Design issues, framing, Error detection and correction	T1,R1	2	11	PPT,WB, NPTEL
9	**Elementary data link protocols:** Stop and wait protocol	T1	1	12	PPT,NPTEL
10	**Sliding Window protocols:** one bit,Go-Back-N, Selective Repeat, Example data link protocols	T1,R2	2	14	PPT,WB,NPTEL
11	**Medium Access sub layer:**The channel allocation problem, Multiple access protocols: ALOHA,CSMA	T1	2	16	PPT,WB, You tube
12	Collision free protocols. Wireless LANs, Data link layer switching	T1,R1	2	18	PPT,WB
	UNIT-III				
13	**Network Layer:**Design issues,	T1,R1	1	19	PPT,WB,NPTEL
14	Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast	T1,R1	2	21	PPT,WB, NPTEL
15	Multicast, distance vector routing,	T1,R2	2	23	PPT,WB, NPTEL
16	Congestion Control Algorithms, Quality of Service	T1,R2	2	24	PPT,WB, YouTube
17	Internetworking	T1	1	25	PPT,WB,YouTube

18	The Network layer in the internet.	T1	1	27	PPT,WB,YouTube
	UNIT-IV				
19	Introduction Transport Layer	T1,R2	1	28	PPT,WB,NPTEL
20	Transport Services	T1,R1	2	30	PPT,NPTEL
21	Elements of Transport protocols	T1,R1	2	32	PPT,YouTube Video
22	Connection management	T1,R1	2	34	PPT,NPTEL
23	TCP and UDP protocols	T1,R2	2	36	PPT,YouTybe
	UNIT-V				
24	**Application Layer**	T1,R2	2	38	PPT,WB
25	Domain name system	T1	2	40	PPT,WB,YouTube
26	SNMP	T1	1	41	PPT,WB,YouTube
27	Electronic Mail; the World WEB,	T1	1	42	PPT,WB,YouTube
28	HTTP	T1,R1	1	43	PPT,WB,YouTube
29	Streaming audio and video	T1,R3	2	45	PPT,WB,YouTube

Text Books:

T1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI.

References:

R1. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education
R2. Data Communications and Networking – Behrouz A. Forouzan. 3rd Edition,TMH.

Signature of Faculty

HOD-CSE

Date:

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sl. No.	Roll Number	Student Name	SEC
1	21H51A0501	BINGI NITHYASRI	A
2	21H51A0503	DASI RASHMIKA	A
3	21H51A0505	GOUNI PAVANI	A
4	21H51A0508	KOMMU VEERENDAR	A
5	21H51A0514	MOHAMMED ABDUL SAMEER	A
6	21H51A0515	MUAAZ MOHAMMED MUNEER	A
7	21H51A0518	PALTHYA SUMAN	A
8	21H51A0519	PAPPULA KARTHIK REDDY	A
9	21H51A0520	POSHETTY VARSHITH	A
10	21H51A0521	RITESH KUMAR	A
11	21H51A0524	TEJAVATH VASANTHA	A
12	21H51A0525	THOTA MAHESHWARI	A
13	21H51A0526	VEERELLI SAIVENKATA REDDY	A
14	21H51A0529	BELKONI ANVESH	A
15	21H51A0533	DASARI AJAY KUMAR	A
16	21H51A0537	GANTA NISHAL	A
17	21H51A0540	KOMMANABOINA ANUSHA	A
18	21H51A0541	LOKOTI SRICHARAN	A
19	21H51A0542	M KAVYA	A
20	21H51A0544	OJAS RAKESH GARPALLIWAR	A
21	21H51A0545	PEDDINTI SAI VARDHAN	A
22	21H51A0547	SATVIKA KARUMUDI	A
23	21H51A0549	THAMMISHETTY SHASHANK	A
24	21H51A0550	TUMMALA VENGAL RAYUDU	A
25	21H51A0551	UMMEDA SHIVA SAI KRISHNA	A
26	21H51A0552	VEMULA PRIYA PRAMIDHA	A
27	21H51A0554	ABHISHEK KUMAR SINGH	A
28	21H51A0555	ALETI ASHWITHA REDDY	A
29	21H51A0556	BATTU VICTOR DINAKAR BABU	A
30	21H51A0559	GANDRATH SRI YAGNA	A
31	21H51A0562	JOGU TARUN TEJA	A
32	21H51A0563	KARRA VINAY REDDY	A
33	21H51A0569	MOHAMMAD FERIA	A
34	21H51A0570	NAGULAPALLY UDAYKIRAN	A
35	21H51A0572	SARVADEY ZANETA	A
36	21H51A0573	SATHYARAM DHANA LAKSHMI	A
37	21H51A0574	SHA SOPNIL JAIN	A
38	21H51A0578	VUPPALA SHLAGHA	A
39	21H51A0582	JYOTHI BALAJI	A
40	21H51A0583	K RITIKA REDDY	A
41	21H51A0584	KOPPULA VENKATA SAI NANDINI	A
42	21H51A0586	M GANESH	A

Sl. No.	Roll Number	Student Name	SEC
43	21H51A0592	NENAVATH SRAVANI RATHOD	A
44	21H51A0595	PAVAN KUMAR	A
45	21H51A0597	ROSHAN TALARI	A
46	21H51A0598	S VARUN	A
47	21H51A05A5	AILENI SATHWIK	A
48	21H51A05A6	AKURATHI RITHVIK SESHAGIRI	A
49	21H51A05A9	BIJJAM SOUMIKA	A
50	21H51A05B0	BODA ASHOK	A
51	21H51A05B6	GOLLAPUDI NITHIN	A
52	21H51A05C1	NALLAKULA KIRANKUMAR	A
53	21H51A05C4	RITVIK PRATHAPANI	A
54	22H55A0501	AILLURI AMARDEEP REDDY	A
55	22H55A0502	BAIROJU SINDHU	A
56	22H55A0503	BODA AVINASH	A
57	22H55A0504	BODA RAHUL SAI KIRAN	A
58	22H55A0505	CHAKILAM BHARAT KUMAR	A
59	22H55A0506	ERLA VENU	A
60	22H55A0507	JONNALA SOWMYA	A
61	22H55A0508	KALE PRABHAS	A
62	22H55A0509	KATKAM MANASWINI	A
63	22H55A0510	KODIDALA KOMALI	A
64	22H55A0511	KONDA MAHIMASRI	A
65	22H55A0512	KONDAPARTHI MANJEERA	A
66	22H55A0513	KUMMARI RAJESH	A
67	22H55A0514	KURUMULA LOKESH	A

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Sl. No.	Roll Number	Student Name	SEC
1	21H51A0502	DASARI HARINI	B
2	21H51A0504	GAJULAPALLE SREE LAKSHMI	B
3	21H51A0506	J AKANSH	B
4	21H51A0507	K ZAYD AHMED	B
5	21H51A0509	KURAPATI ESHWAR	B
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7	21H51A0511	MAHANTHI SAI MANYA SRI	B
8	21H51A0512	MANAS CHHATWAL	B
9	21H51A0513	MANGINA SRI VENKATA SAI	B
10	21H51A0516	NAGIREDDY ANVITHA	B
11	21H51A0517	PADALA ANIL KUMAR	B
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17	21H51A0531	BENKI VARSHITHA RANI	B
18	21H51A0532	BOLLU HARI CHARHAN	B
19	21H51A0534	DAVULURI SAI SUJAN	B
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26	21H51A0553	ABBULA VINUTHNA	B
27	21H51A0557	BUCHENELLI NIKHILESH REDDY	B
28	21H51A0558	DANDA VENKATA SATHWIK REDDY	B
29	21H51A0560	GORINTA RAHULU	B
30	21H51A0561	GUNREDDY AKSHITH REDDY	B
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32	21H51A0565	KONDA VISHAL GOUD	B
33	21H51A0566	KURAKULA SHAILESH	B
34	21H51A0567	MADIRA SAI RISHITHA	B
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36	21H51A0571	NIMMALA SAI	B
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44	21H51A0587	MANDALOJU VASANTH KUMAR	B
45	21H51A0588	MOHAMMAD ABDUL KALAM	B
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50	21H51A0594	PANCHAGNULA VINUTNA	B
51	21H51A0596	RAGE DAMODHAR	B
52	21H51A0599	SAI KIRAN B L S	B
53	21H51A05A0	SHESHAVAMATAM SUCHIT PAUL	B
54	21H51A05A1	TEEGALA BHANU TEJA REDDY	B
55	21H51A05A2	VADDI RISHIKA	B
56	21H51A05A3	YADDANAPUDI VISHNU SRIVATSAVA	B
57	21H51A05A4	YELDI ARUN	B
58	21H51A05A7	BAJRANG HARSH SINGH	B
59	21H51A05A8	BASAR SHYAM SUNDER RAO	B
60	21H51A05B1	BUNNI SHARANYA	B
61	21H51A05B2	C J VISHNU PRAKASH	B
62	21H51A05B3	CHIMMULA SHIVA PRASAD REDDY	B
63	21H51A05B4	DOLLA RENUKA	B
64	21H51A05B5	ERUKULA RAJASREE	B
65	21H51A05B7	HARIKA REDDY GANTA	B
66	21H51A05B8	INDUPALLI SHARONSUDHA	B
67	21H51A05B9	MADULAPURAM SAI YASHWANTH RAJ	B
68	21H51A05C0	MALLELA SINDHUJA	B
69	21H51A05C2	RANGU ABHINAV	B
70	21H51A05C3	RAYABARAPU CHATHURYA	B
71	21H51A05C5	SEGU JAYA BALA HARSHAVARDHAN	B
72	21H51A05C8	THATIKONDA AKHILA	B
73	21H51A05C9	VAKALA KAVYA SAI SUMA SRI	B
74	21H51A05D1	ANUJ KUMAR	B
75	21H51A05D2	BACHAWAR VINITHA	B

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Sl. No.	Roll Number	Student Name	SEC
1	21H51A05C6	SOMU KOTESWARA REDDY	C
2	21H51A05C7	SUNKAPAKA JOHN	C
3	21H51A05D0	VALLAMKONDA POOJITHA	C
4	21H51A05D3	BASHAM RAJU	C
5	21H51A05D4	BUSSA TEJASWINI	C
6	21H51A05D5	DADE DINISHA	C
7	21H51A05D6	DEEKONDA SAKETH	C
8	21H51A05E3	MANCHI AKSHAYA	C
9	21H51A05E4	MOHAMMAD ARSHAD NIZAMI	C
10	21H51A05F1	P Y GEETHA MADHURI	C
11	21H51A05F3	SHAIK ILLIYAZ	C
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19	21H51A05J8	GUNTHAPALLI MALINI	C
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32	21H51A05N5	PULI PRANEETH GOUD	C
33	21H51A05P0	TALOORI PRABHU KIRAN	C
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35	21H51A05P4	ALLURI SAI SATHWIK REDDY	C
36	21H51A05P5	ANDE AJAY	C
37	21H51A05P7	BESTHA NANDA KISHORE	C
38	21H51A05P8	CHAVATAPALLI MUKUNDA SRI HASINI	C
39	21H51A05P9	CHEPYALA SATHWIK REDDY	C

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40	21H51A05Q1	DAGGULA PRASHANTH	C
41	21H51A05Q2	GAJULA NAVANEETH	C
42	21H51A05Q3	GUDAPATI NITHIN KUMAR	C
43	21H51A05R3	PINAPATI ABHISHEK	C
44	21H51A05R4	RACHAMALLA SAI UJITHA REDDY	C
45	21H51A05R5	SATTU RAKESH	C
46	21H51A05R6	SHREYA M	C
47	21H51A05R7	YERAVELLI RUCHITHA	C
48	22H55A0515	M. SAI RANJITH REDDY	C
49	22H55A0516	MAHATHI DESAI	C
50	22H55A0517	MD TOWHEED	C
51	22H55A0518	MOHAMMED HANEF	C
52	22H55A0519	NAGARAM SHIVA CHAND	C
53	22H55A0520	NARGE CHARANETEJA	C
54	22H55A0521	NEELAM RAMYA SARI	C
55	22H55A0522	PANDAV SONIA	C
56	22H55A0523	PATHLAVATH SUNITHA	C
57	22H55A0524	POTTIPALLY DEEPIKA	C
58	22H55A0525	PULIGANTI MAHENDAR	C
59	22H55A0526	SARDESHI PRAVEEN KUMAR	C
60	22H55A0527	VISLAVATH ANITHA	C

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Sl. No.	Roll Number	Student Name	SEC
1	21H51A05D7	DHUDURI SATHVIKA	D
2	21H51A05D8	GAMPALA SRI DURGA PRABHATH	D
3	21H51A05D9	GUNDLA VAMSHIDHAR	D
4	21H51A05E0	KASANAGOTTU AMULYA	D
5	21H51A05E1	KOTHA VAISHNAVI	D
6	21H51A05E2	KUMBALA ABHILASH REDDY	D
7	21H51A05E6	NAKKALA KEERTHANA	D
8	21H51A05E7	NEELAM BHARATH KUMAR	D
9	21H51A05E8	NEERUDI HARIPRASAD	D
10	21H51A05E9	ODURI VEERAMANIKANTA	D
11	21H51A05F0	OM GUPTA	D
12	21H51A05F2	ROHAN SACHIN RAKHE	D
13	21H51A05F4	SHAIK TASNIM	D
14	21H51A05F6	YARRAMSETTI MADHU VENKATA	D
15	21H51A05F7	BABBI THAPA	D
16	21H51A05G0	GUDIPALLY SAI SANJAY	D
17	21H51A05G1	GUNNA VINAY KUMAR REDDY	D
18	21H51A05G3	K SRI HARINI	D
19	21H51A05G4	KANDI SWETHA	D
20	21H51A05G6	KHANDESH THANU SRI	D
21	21H51A05G7	MAMIDI VENU GOPAL	D
22	21H51A05G8	MARAGONI KARTHIKEYA	D
23	21H51A05G9	NALIMELA JITHIN REDDY	D
24	21H51A05H1	PATRAYADI RAVI	D
25	21H51A05H3	POTHARAJU SAI KIRAN	D
26	21H51A05H5	SHERIKAR RAHUL	D
27	21H51A05H6	SOMARAJUPALLI THEJASWI	D
28	21H51A05H7	SUDAM SHIVA	D
29	21H51A05H9	THALLAM GEETHAN	D
30	21H51A05J0	TODUPUNURI SHAI PRIYA	D
31	21H51A05J1	TUMMALA SAHITH	D
32	21H51A05J2	VIJAYAGIRI AMULYA	D
33	21H51A05J3	ABHAY PRATAP SINGH	D
34	21H51A05J4	AYEMON ZEBA	D
35	21H51A05J5	BONDALA SRINATH	D
36	21H51A05J6	DODDAPANENI MEGHAN CHOWDARY	D
37	21H51A05J7	GORANTI SANTHU SATHWIK	D
38	21H51A05K0	KACHIREDDY JAYASREE	D
39	21H51A05K1	KAJA SANJEEV KUMAR	D

Sl. No.	Roll Number	Student Name	SEC
40	21H51A05K2	KANTU ANANTHKUMAR	D
41	21H51A05K4	KONDETI VIKRAMREDDY	D
42	21H51A05K5	KRITIKA KHATRI	D
43	21H51A05K6	NITYANANDAYYA MATHPATHI	D
44	21H51A05K9	SHANIGALA VISHNU	D
45	21H51A05L0	SINDEY ABHIGNA	D
46	21H51A05L2	SUMESH	D
47	21H51A05L3	TANNIRU MAHESH	D
48	21H51A05L4	TUSYAA SREERALA	D
49	21H51A05L5	UNI SAILESH	D
50	21H51A05L6	VAGUAMRI SRINANDHAN	D
51	21H51A05L8	BEHARA SURAJ	D
52	21H51A05L9	BHAKE SHASHANK	D
53	21H51A05M2	DIVYA GAUTAM	D
54	21H51A05M3	GANGASANI SHANKARSHAN	D
55	21H51A05M5	GUMMIREDDY SAINATH REDDY	D
56	21H51A05M6	KALLURI THANMAI	D
57	21H51A05M7	KATRAVATH MANJULA	D
58	21H51A05M8	MOHAMMED SAMEER ALI	D
59	21H51A05N0	NANCHARLA SAI AKSHITHA	D
60	21H51A05N2	OLIGE RANI	D
61	21H51A05N6	SAKKERLA RAJ KUMAR	D
62	21H51A05N7	SALENDRA MANOJ KUMAR	D
63	21H51A05N8	SHAIK JAVED	D
64	21H51A05N9	SHRIYA MALANI	D
65	21H51A05P1	VASURI VINAY KUMAR	D
66	21H51A05P3	VITTAPUR BINNU REDDY	D
67	21H51A05P6	BANOTHU DALI HIMASRI	D
68	21H51A05Q0	D GAYATHRI	D
69	21H51A05Q4	GUDIPUDI DHEERAJ	D
70	21H51A05Q5	GURRAM SRIKANTH	D
71	21H51A05Q6	KALVAKUNTA CHANDRASHEKAR	D
72	21H51A05Q7	KAPU HARSHA VARDAN REDDY	D
73	21H51A05Q8	KOTTE MOUNIKA	D
74	21H51A05Q9	MANDA VIGHNESHWARA REDDY	D
75	21H51A05R0	MANDHUMULA DEEPAK	D
76	21H51A05R1	PEDDI PRAVALIKA REDDY	D
77	21H51A05R2	PENDEM YOGITHA	D
78	21H51A05R8	YESUGARI ADHARSH	D

CMR College of Engineering & Technology

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Kandlakoya, Medchal Road - 501401

Department of Computer Science and Engineering

MID-I MARKS LIST — A.Y.2023-24

Class : III B.Tech. I SEM CSE SECTION-A

SUBJECT : COMPUTER NETWORK (A30544)

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A0501	BINGI NITHYASRI	5	21	26
2	21H51A0503	DASI RASHMIKA	5	20	25
3	21H51A0505	GOUNI PAVANI	5	24	29
4	21H51A0508	KOMMU VEERENDAR	5	17	22
5	21H51A0514	MOHAMMED ABDUL SAMEER	5	21	26
6	21H51A0515	MUAAZ MOHAMMED MUNEER	5	24	29
7	21H51A0518	PALTHYA SUMAN	5	15	20
8	21H51A0519	PAPPULA KARTHIK REDDY	0	24	24
9	21H51A0520	POSHETTY VARSHITH	5	18	23
10	21H51A0521	RITESH KUMAR	5	18	23
11	21H51A0524	TEJAVATH VASANTHA	5	25	30
12	21H51A0525	THOTA MAHESHWARI	5	22	27
13	21H51A0526	VEERELLI SAIVENKATA REDDY	0	AB	00
14	21H51A0529	BELKONI ANVESH	5	22	27
15	21H51A0533	DASARI AJAY KUMAR	5	~~AB~~ 14	~~05~~ 19
16	21H51A0537	GANTA NISHAL	5	16	21
17	21H51A0540	KOMMANABOINA ANUSHA	5	21	26
18	21H51A0541	LOKOTI SRICHARAN	5	22	27
19	21H51A0542	M KAVYA	5	20	25
20	21H51A0544	OJAS RAKESH GARPALLIWAR	5	15	20
21	21H51A0545	PEDDINTI SAI VARDHAN	5	11	16
22	21H51A0547	SATVIKA KARUMUDI	5	23	28
23	21H51A0549	THAMMISHETTY SHASHANK	5	~~AB~~ 10	~~05~~ 15
24	21H51A0550	TUMMALA VENGAL RAYUDU	5	14	19
25	21H51A0551	UMMEDA SHIVA SAI KRISHNA	0	~~AB~~ 18	~~00~~ 18
26	21H51A0552	VEMULA PRIYA PRAMIDHA	5	25	30
27	21H51A0554	ABHISHEK KUMAR SINGH	5	22	27
28	21H51A0555	ALETI ASHWITHA REDDY	5	21	26
29	21H51A0556	BATTU VICTOR DINAKAR BABU	5	16	21
30	21H51A0559	GANDRATH SRI YAGNA	0	13	13
31	21H51A0562	JOGU TARUN TEJA	5	16	21
32	21H51A0563	KARRA VINAY REDDY	5	~~AB~~ 10	~~05~~ 15
33	21H51A0569	MOHAMMAD FERIA	5	14	19
34	21H51A0570	NAGULAPALLY UDAYKIRAN	5	14	19
35	21H51A0572	SARVADEY ZANETA	5	22	27
36	21H51A0573	SATHYARAM DHANA LAKSHMI	5	23	28
37	21H51A0574	SHA SOPNIL JAIN	5	22	27
38	21H51A0578	VUPPALA SHLAGHA	5	25	30
39	21H51A0582	JYOTHI BALAJI	5	19	24
40	21H51A0583	K RITIKA REDDY	5	10	15

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
41	21H51A0584	KOPPULA VENKATA SAI NANDINI	5	~~AB~~ 14	~~05~~ 19
42	21H51A0586	M GANESH	5	~~AB~~ 21	~~05~~ 26
43	21H51A0592	NENAVATH SRAVANI RATHOD	5	25	30
44	21H51A0595	PAVAN KUMAR	0	~~AB~~ 19	~~00~~ 19
45	21H51A0597	ROSHAN TALARI	0	22	22
46	21H51A0598	S VARUN	5	18	23
47	21H51A05A5	AILENI SATHWIK	5	10	15
48	21H51A05A6	AKURATHI RITHVIK SESHAGIRI	5	08	13
49	21H51A05A9	BIJJAM SOUMIKA	5	~~AB~~ 13	~~05~~ 18
50	21H51A05B0	BODA ASHOK	5	06	11
51	21H51A05B6	GOLLAPUDI NITHIN	5	14	19
52	21H51A05C1	NALLAKULA KIRANKUMAR	5	~~AB~~ 07	~~05~~ 12
53	21H51A05C4	RITVIK PRATHAPANI	5	13	18
54	22H55A0501	AILLURI AMARDEEP REDDY	5	15	20
55	22H55A0502	BAIROJU SINDHU	5	17	22
56	22H55A0503	BODA AVINASH	5	16	21
57	22H55A0504	BODA RAHUL SAI KIRAN	0	14	14
58	22H55A0505	CHAKILAM BHARAT KUMAR	5	25	30
59	22H55A0506	ERLA VENU	5	23	28
60	22H55A0507	JONNALA SOWMYA	5	20	25
61	22H55A0508	KALE PRABHAS	5	21	26
62	22H55A0509	KATKAM MANASWINI	5	22	27
63	22H55A0510	KODIDALA KOMALI	5	22	27
64	22H55A0511	KONDA MAHIMASRI	5	21	26
65	22H55A0512	KONDAPARTHI MANJEERA	5	24	29
66	22H55A0513	KUMMARI RAJESH	5	14	19
67	22H55A0514	KURUMULA LOKESH	5	13	18

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Department of Computer Science and Engineering

MID-I MARKS LIST

Class : III B.Tech. I SEM CSE SECTION-B A.Y.2023-24

SUBJECT : Computer Networks

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A0502	DASARI HARINI	5	24	29
2	21H51A0504	GAJULAPALLE SREE LAKSHMI	5	25	30
3	21H51A0506	J AKANSH	5	23	28
4	21H51A0507	K ZAYD AHMED	5	19	24
5	21H51A0509	KURAPATI ESHWAR	5	23	28
6	21H51A0510	LAVANGU VAISHNAVI	5	24	29
7	21H51A0511	MAHANTHI SAI MANYA SRI	5	22	27
8	21H51A0512	MANAS CHHATWAL	5	22	27
9	21H51A0513	MANGINA SRI VENKATA SAI	5	20	25
10	21H51A0516	NAGIREDDY ANVITHA	5	23	28
11	21H51A0517	PADALA ANIL KUMAR	5	21	26
12	21H51A0522	SHREYASH SANJEEV KUMAR	5	23	28
13	21H51A0523	SIDDAMSHETTI SUMITH	5	20	25
14	21H51A0527	AKSHAT KALA	5	24	29
15	21H51A0528	ALAVALA KAVYA	5	24	29
16	21H51A0530	BENKI JYOTHIKA	5	24	29
17	21H51A0531	BENKI VARSHITHA RANI	5	23	28
18	21H51A0532	BOLLU HARI CHARHAN	5	20	25
19	21H51A0534	DAVULURI SAI SUJAN	5	23	28
20	21H51A0535	DESHAPATHI SAHITHI	5	25	30
21	21H51A0536	DHULIPALLA VENKATA SAI SIVA	5	23	28
22	21H51A0539	KOLAN SAHASRA REDDY	5	23	28
23	21H51A0543	MANGA TARAKA RATNA YOSHITH	5	22	27
24	21H51A0546	SAPNA TIWARI	5	21	26
25	21H51A0548	THAKUR ABHINAV SINGH	5	21	26
26	21H51A0553	ABBULA VINUTHNA	5	19	24
27	21H51A0557	BUCHENELLI NIKHILESH REDDY	5	21	26
28	21H51A0558	DANDA VENKATA SATHWIK REDDY	5	22	27
29	21H51A0560	GORINTA RAHULU	5	20	25
30	21H51A0561	GUNREDDY AKSHITH REDDY	5	22	27
31	21H51A0564	KODURU PRANATHI	5	25	30
32	21H51A0565	KONDA VISHAL GOUD	5	24	29
33	21H51A0566	KURAKULA SHAILESH	5	24	29
34	21H51A0567	MADIRA SAI RISHITHA	5	22	27
35	21H51A0568	MANURI CHANDU BABU	5	20	25
36	21H51A0571	NIMMALA SAI	5	20	25
37	21H51A0575	TUDURU SATHWIK	5	21	26
38	21H51A0576	U NAGA MANASWINI	5	22	27
39	21H51A0577	VARLA RAMAKRISHNA REDDY	5	23	28
40	21H51A0579	AMBATI ROHITH RAJU	5	16	21

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
41	21H51A0580	BAIRA ANUSHA	5	25	30
42	21H51A0581	GUNNALA AKHILA	5	24	29
43	21H51A0585	KUDUMULA ANVESH REDDY	5	22	27
44	21H51A0587	MANDALOJU VASANTH KUMAR	5	18	23
45	21H51A0588	MOHAMMAD ABDUL KALAM	5	20	25
46	21H51A0589	MOHAMMED MUDASSIR ALI	5	24	29
47	21H51A0590	NALABOLU MOUNIKA	5	20	25
48	21H51A0591	NAMPALLY SIDDHARTHA	5	21	26
49	21H51A0593	PAMULA BEULAH SUPRAGNYA	5	24	29
50	21H51A0594	PANCHAGNULA VINUTNA	5	22	27
51	21H51A0596	RAGE DAMODHAR	5	22	27
52	21H51A0599	SAI KIRAN B L S	5	18	23
53	21H51A05A0	SHESHAVAMATAM SUCHIT PAUL	5	16	21
54	21H51A05A1	TEEGALA BHANU TEJA REDDY	5	21	26
55	21H51A05A2	VADDI RISHIKA	5	23	28
56	21H51A05A3	YADDANAPUDI VISHNU SRIVATSAVA	5	21	26
57	21H51A05A4	YELDI ARUN	5	23	28
58	21H51A05A7	BAJRANG HARSH SINGH	5	23	28
59	21H51A05A8	BASAR SHYAM SUNDER RAO	5	24	29
60	21H51A05B1	BUNNI SHARANYA	5	25	30
61	21H51A05B2	C J VISHNU PRAKASH	5	22	27
62	21H51A05B3	CHIMMULA SHIVA PRASAD REDDY	5	19	24
63	21H51A05B4	DOLLA RENUKA	5	22	27
64	21H51A05B5	ERUKULA RAJASREE	5	23	28
65	21H51A05B7	HARIKA REDDY GANTA	5	22	27
66	21H51A05B8	INDUPALLI SHARONSUDHA	5	23	28
67	21H51A05B9	MADULAPURAM SAI YASHWANTH RAJ	5	22	27
68	21H51A05C0	MALLELA SINDHUJA	5	24	29
69	21H51A05C2	RANGU ABHINAV	5	23	28
70	21H51A05C3	RAYABARAPU CHATHURYA	5	17	22
71	21H51A05C5	SEGU JAYA BALA HARSHAVARDHAN	5	23	28
72	21H51A05C8	THATIKONDA AKHILA	5	23	28
73	21H51A05C9	VAKALA KAVYA SAI SUMA SRI	5	24	29
74	21H51A05D1	ANUJ KUMAR	5	21	26
75	21H51A05D2	BACHAWAR VINITHA	5	24	29

Name&Signature of the Faculty : B. Gayathri Gayathri

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Mobile No : 8186823782

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Department of Computer Science and Engineering

MID-1 MARKS LIST

Class : III B.Tech. I SEM CSE SECTION-C A.Y.2023-24

SUBJECT : Computer Networks

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A05C6	SOMU KOTESWARA REDDY	5	14	19
2	21H51A05C7	SUNKAPAKA JOHN	5	14	19
3	21H51A05D0	VALLAMKONDA POOJITHA	5	19	24
4	21H51A05D3	BASHAM RAJU	5	16	21
5	21H51A05D4	BUSSA TEJASWINI	5	15	20
6	21H51A05D5	DADE DINISHA	5	21	26
7	21H51A05D6	DEEKONDA SAKETH	AB	14	14
8	21H51A05E3	MANCHI AKSHAYA	5	18	23
9	21H51A05E4	MOHAMMAD ARSHAD NIZAMI	5	21	26
10	21H51A05F1	P Y GEETHA MADHURI	5	20	25
11	21H51A05F3	SHAIK ILLIYAZ	5	~~AB~~ 14	~~5~~ 19
12	21H51A05F5	TUSHAR PUNIA	5	~~AB~~ 17	~~5~~ 22
13	21H51A05F8	DODDI SAI PHANI HARI CHANDANA	5	21	26
14	21H51A05F9	GADUGULA KALYANI	5	18	23
15	21H51A05G2	IYLA SNEHARIKA	5	23	28
16	21H51A05G5	KANUGO NESHIT RAJ	AB	13	13
17	21H51A05H2	PODDUTURI NITHIN REDDY	5	11	16
18	21H51A05H8	TADEM RAVITEJA	03	16	19
19	21H51A05J8	GUNTHAPALLI MALINI	5	11	16
20	21H51A05J9	GURRAM KRISHNA PRASANTH	AB	~~AB AB 19~~	~~AB AB~~ +9
21	21H51A05K3	KODIGANTI SAI KISHORE	AB	~~AB~~ 19	~~AB~~ 19
22	21H51A05K8	SEELAMSETTY PRASANNA GAYATHRI	5	16	21
23	21H51A05L1	SRIRAM NAGARAJU	5	19	24
24	21H51A05L7	YALLA TEJASWIK REDDY	3	13	16
25	21H51A05L8	BEHARA SURAJ	5	17	22
26	21H51A05M0	CHILUKA SAI KARTHIK	5	16	21
27	21H51A05M1	DAMARLA HEMAVATHI	3	13	16
28	21H51A05M4	GIRAVENA ARYA	5	12	17
29	21H51A05M9	MOKIRALA JHANSI	5	19	24
30	21H51A05N1	NEELA SAI ADITYA	5	10	15
31	21H51A05N3	POTRU SAI NITISH	5	~~AB~~ 16	~~05~~ 21
32	21H51A05N4	PRAHARSHITHA SURAGONI	5	~~AB~~ 13	~~05~~ 18
33	21H51A05N5	PULI PRANEETH GOUD	5	17	22
34	21H51A05P0	TALOORI PRABHU KIRAN	5	13	18
35	21H51A05P2	VAVILLA RAVITEJA	3	21	24
36	21H51A05P4	ALLURI SAI SATHWIK REDDY	5	19	24
37	21H51A05P5	ANDE AJAY	5	~~AB~~ 23	~~05~~ 28
38	21H51A05P7	BESTHA NANDA KISHORE	5	15	20
39	21H51A05P8	CHAVATAPALLI MUKUNDA SRI HASINI	5	18	23
40	21H51A05P9	CHEPYALA SATHWIK REDDY	5	15	20

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
41	21H51A05Q1	DAGGULA PRASHANTH	5	16	21
42	21H51A05Q2	GAJULA NAVANEETH	5	14	19
43	21H51A05Q3	GUDAPATI NITHIN KUMAR	5	14	19
44	21H51A05R3	PINAPATI ABHISHEK	5	15	20
45	21H51A05R4	RACHAMALLA SAI UJITHA REDDY	5	20	25
46	21H51A05R5	SATTU RAKESH	5	20	25
47	21H51A05R6	SHREYA M	5	21	26
48	21H51A05R7	YERAVELLI RUCHITHA	5	20	25
49	22H55A0515	M. SAI RANJITH REDDY	5	~~AB~~ 16	~~AB~~ 21
50	22H55A0516	MAHATHI DESAI	5	18	23
51	22H55A0517	MD TOWHEED	AB	10	10
52	22H55A0518	MOHAMMED HANEF	AB	05	05
53	22H55A0519	NAGARAM SHIVA CHAND	03	16	19
54	22H55A0520	NARGE CHARANETEJA	~~AB~~	~~AB~~ 13	~~AB~~ 13
55	22H55A0521	NEELAM RAMYA SARI	05	16	21
56	22H55A0522	PANDAV SONIA	5	21	26
57	22H55A0523	PATHLAVATH SUNITHA	5	20	25
58	22H55A0524	POTTIPALLY DEEPIKA	5	18	23
59	22H55A0525	PULIGANTI MAHENDAR	5	20	25
60	22H55A0526	SARDESHI PRAVEEN KUMAR	5	~~AB~~ 19	~~05~~ 24
61	22H55A0527	VISLAVATH ANITHA	5	20	25

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Department of Computer Science and Engineering

MID-I MARKS LIST

Class : III B.Tech. I SEM CSE SECTION-D A.Y.2023-24

SUBJECT : Computer Networks (A30514)

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A05D7	DHUDURI SATHVIKA	05	24	29
2	21H51A05D8	GAMPALA SRI DURGA PRABHATH	05	19	24
3	21H51A05D9	GUNDLA VAMSHIDHAR	05	18	23
4	21H51A05E0	KASANAGOTTU AMULYA	05	24	29
5	21H51A05E1	KOTHA VAISHNAVI	05	24	29
6	21H51A05E2	KUMBALA ABHILASH REDDY	05	22	27
7	21H51A05E6	NAKKALA KEERTHANA	05	24	29
8	21H51A05E7	NEELAM BHARATH KUMAR	05	18	23
9	21H51A05E8	NEERUDI HARIPRASAD	05	24	29
10	21H51A05E9	ODURI VEERAMANIKANTA	05	23	28
11	21H51A05F0	OM GUPTA	05	23	28
12	21H51A05F2	ROHAN SACHIN RAKHE	05	24	29
13	21H51A05F4	SHAIK TASNIM	05	24	29
14	21H51A05F6	YARRAMSETTI MADHU VENKATA	05	24	29
15	21H51A05F7	BABBI THAPA	05	22	27
16	21H51A05G0	GUDIPALLY SAI SANJAY	05	24	29
17	21H51A05G1	GUNNA VINAY KUMAR REDDY	05	22	27
18	21H51A05G3	K SRI HARINI	05	24	29
19	21H51A05G4	KANDI SWETHA	05	24	29
20	21H51A05G6	KHANDESH THANU SRI	05	23	28
21	21H51A05G7	MAMIDI VENU GOPAL	05	24	29
22	21H51A05G8	MARAGONI KARTHIKEYA	05	23	28
23	21H51A05G9	NALIMELA JITHIN REDDY	05	19	24
24	21H51A05H1	PATRAYADI RAVI	05	24	29
25	21H51A05H3	POTHARAJU SAI KIRAN	05	23	28
26	21H51A05H5	SHERIKAR RAHUL	05	23	28
27	21H51A05H6	SOMARAJUPALLI THEJASWI	05	22	27
28	21H51A05H7	SUDAM SHIVA	05	23	28
29	21H51A05H9	THALLAM GEETHAN	05	25	30
30	21H51A05J0	TODUPUNURI SHAI PRIYA	05	25	30
31	21H51A05J1	TUMMALA SAHITH	05	18	23
32	21H51A05J2	VIJAYAGIRI AMULYA	05	21	26
33	21H51A05J3	ABHAY PRATAP SINGH	05	17	22
34	21H51A05J4	AYEMON ZEBA	05	23	28
35	21H51A05J5	BONDALA SRINATH	05	22	27
36	21H51A05J6	DODDAPANENI MEGHAN CHOWDARY	05	24	29
37	21H51A05J7	GORANTI SANTHU SATHWIK	05	22	27
38	21H51A05K0	KACHIREDDY JAYASREE	05	24	29
39	21H51A05K1	KAJA SANJEEV KUMAR	05	23	28
40	21H51A05K2	KANTU ANANTHKUMAR	05	22	27

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
41	21H51A05K4	KONDETI VIKRAMREDDY	05	22	27
42	21H51A05K5	KRITIKA KHATRI	05	25	30
43	21H51A05K6	NITYANANDAYYA MATHPATHI	05	22	27
44	21H51A05K9	SHANIGALA VISHNU	05	22	27
45	21H51A05L0	SINDEY ABHIGNA	05	24	29
46	21H51A05L2	SUMESH	05	21	26
47	21H51A05L3	TANNIRU MAHESH	05	21	26
48	21H51A05L4	TUSYAA SREERALA,	05	24	29
49	21H51A05L5	UNI SAILESH	05	24	29
50	21H51A05L6	VAGUAMRI SRINANDHAN	05	24	29
51	21H51A05L9	BHAKE SHASHANK	05	24	29
52	21H51A05M2	DIVYA GAUTAM	05	A3	~~05~~ 28
53	21H51A05M3	GANGASANI SHANKARSHAN	05	25	30
54	21H51A05M5	GUMMIREDDY SAINATH REDDY	05	25	30
55	21H51A05M6	KALLURI THANMAI	05	24	29
56	21H51A05M7	KATRAVATH MANJULA	05	23	28
57	21H51A05M8	MOHAMMED SAMEER ALI	05	24	29
58	21H51A05N0	NANCHARLA SAI AKSHITHA	05	22	27
59	21H51A05N2	OLIGE RANI	05	25	30
60	21H51A05N6	SAKKERLA RAJ KUMAR	05	18	23
61	21H51A05N7	SALENDRA MANOJ KUMAR	05	22	27
62	21H51A05N8	SHAIK JAVED	05	24	29
63	21H51A05N9	SHRIYA MALANI	05	25	30
64	21H51A05P1	VASURI VINAY KUMAR	05	A22	A27
65	21H51A05P3	VITTAPUR BINNU REDDY	05	25	30
66	21H51A05P6	BANOTHU DALI HIMASRI	05	25	30
67	21H51A05Q0	D GAYATHRI	05	24	29
68	21H51A05Q4	GUDIPUDI DHEERAJ	05	23	28
69	21H51A05Q5	GURRAM SRIKANTH	05	24	29
70	21H51A05Q6	KALVAKUNTA CHANDRASHEKAR	05	22	27
71	21H51A05Q7	KAPU HARSHA VARDAN REDDY	05	24	29
72	21H51A05Q8	KOTTE MOUNIKA	05	21	26
73	21H51A05Q9	MANDA VIGHNESHWARA REDDY	05	21	26
74	21H51A05R0	MANDHUMULA DEEPAK	05	22	27
75	21H51A05R1	PEDDI PRAVALIKA REDDY	05	20	25
76	21H51A05R2	PENDEM YOGITHA	05	24	29
77	21H51A05R8	YESUGARI ADHARSH	05	23	28

Name&Signature of the Faculty :	B.K. Chinna.M.
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HOD/CSE

CMR College of Engineering & Technology

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Kandlakoya , Medchal Road - 501401

Department of Computer Science and Engineering

MID-II MARKS LIST

A.Y.2023-24

Class : III B.Tech. I SEM CSE SECTION-A

SUBJECT : COMPUTER NETWORKS (CD305IH)

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A0501	BINGI NITHYASRI	5	21	26
2	21H51A0503	DASI RASHMIKA	5	20	25
3	21H51A0505	GOUNI PAVANI	5	20	25
4	21H51A0508	KOMMU VEERENDAR	5	20	25
5	21H51A0514	MOHAMMED ABDUL SAMEER	5	13	18
6	21H51A0515	MUAAZ MOHAMMED MUNEER	5	19	24
7	21H51A0518	PALTHYA SUMAN	5	21	26
8	21H51A0519	PAPPULA KARTHIK REDDY	0	13	13
9	21H51A0520	POSHETTY VARSHITH	0	18	18
10	21H51A0521	RITESH KUMAR	5	13	18
11	21H51A0524	TEJAVATH VASANTHA	5	24	29
12	21H51A0525	THOTA MAHESHWARI	5	21	26
13	21H51A0526	VEERELLI SAIVENKATA REDDY	0	AB	00
14	21H51A0529	BELKONI ANVESH	5	21	26
15	21H51A0533	DASARI AJAY KUMAR	5	23	28
16	21H51A0537	GANTA NISHAL	5	18	23
17	21H51A0540	KOMMANABOINA ANUSHA	5	21	26
18	21H51A0541	LOKOTI SRICHARAN	5	12	17
19	21H51A0542	M KAVYA	5	AB	05
20	21H51A0544	OJAS RAKESH GARPALLIWAR	0	20	20
21	21H51A0545	PEDDINTI SAI VARDHAN	5	14	19
22	21H51A0547	SATVIKA KARUMUDI	5	25	30
23	21H51A0549	THAMMISHETTY SHASHANK	5	12	17
24	21H51A0550	TUMMALA VENGAL RAYUDU	05	17	22
25	21H51A0551	UMMEDA SHIVA SAI KRISHNA	0	14	14
26	21H51A0552	VEMULA PRIYA PRAMIDHA	5	21	26
27	21H51A0554	ABHISHEK KUMAR SINGH	5	22	27
28	21H51A0555	ALETI ASHWITHA REDDY	5	21	26
29	21H51A0556	BATTU VICTOR DINAKAR BABU	5	AB	05
30	21H51A0559	GANDRATH SRI YAGNA	0	21	21
31	21H51A0562	JOGU TARUN TEJA	0	14	14
32	21H51A0563	KARRA VINAY REDDY	5	16	21
33	21H51A0569	MOHAMMAD FERIA	5	21	26
34	21H51A0570	NAGULAPALLY UDAYKIRAN	5	17	22
35	21H51A0572	SARVADEY ZANETA	5	16	21

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
36	21H51A0573	SATHYARAM DHANA LAKSHMI	5	22	27
37	21H51A0574	SHA SOPNIL JAIN	5	21	26
38	21H51A0578	VUPPALA SHLAGHA	5	22	27
39	21H51A0582	JYOTHI BALAJI	5	18	23
40	21H51A0583	K RITIKA REDDY	5	12	17
41	21H51A0584	KOPPULA VENKATA SAI NANDINI	5	16	21
42	21H51A0586	M GANESH	5	18	23
43	21H51A0592	NENAVATH SRAVANI RATHOD	5	23	28
44	21H51A0595	PAVAN KUMAR	0	~~AB~~ 17	~~00~~ 17
45	21H51A0597	ROSHAN TALARI	0	22	22
46	21H51A0598	S VARUN	5	20	25
47	21H51A05A5	AILENI SATHWIK	5	09	14
48	21H51A05A6	AKURATHI RITHVIK SESHAGIRI	5	12	17
49	21H51A05A9	BIJJAM SOUMIKA	5	AB	05
50	21H51A05B0	BODA ASHOK	5	14	19
51	21H51A05B6	GOLLAPUDI NITHIN	5	09	14
52	21H51A05C1	NALLAKULA KIRANKUMAR	5	13	18
53	21H51A05C4	RITVIK PRATHAPANI	5	11	16
54	22H55A0501	AILLURI AMARDEEP REDDY	5	21	26
55	22H55A0502	BAIROJU SINDHU	5	22	27
56	22H55A0503	BODA AVINASH	5	18	23
57	22H55A0504	BODA RAHUL SAI KIRAN	0	12	12
58	22H55A0505	CHAKILAM BHARAT KUMAR	5	23	28
59	22H55A0506	ERLA VENU	5	21	26
60	22H55A0507	JONNALA SOWMYA	5	20	25
61	22H55A0508	KALE PRABHAS	5	22	27
62	22H55A0509	KATKAM MANASWINI	5	21	26
63	22H55A0510	KODIDALA KOMALI	5	20	25
64	22H55A0511	KONDA MAHIMASRI	5	21	26
65	22H55A0512	KONDAPARTHI MANJEERA	5	22	27
66	22H55A0513	KUMMARI RAJESH	5	18	23
67	22H55A0514	KURUMULA LOKESH	5	16	21

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Department of Computer Science and Engineering

MID-II MARKS LIST

Class : III B.Tech. I SEM CSE SECTION-B A.Y.2023-24

SUBJECT : Computer networks

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A0502	DASARI HARINI	5	25	30
2	21H51A0504	GAJULAPALLE SREE LAKSHMI	5	25	30
3	21H51A0506	J AKANSH	5	24	29
4	21H51A0507	K ZAYD AHMED ,	5	23	28
5	21H51A0509	KURAPATI ESHWAR	5	23	28
6	21H51A0510	LAVANGU VAISHNAVI	5	25	30
7	21H51A0511	MAHANTHI SAI MANYA SRI	5	23	28
8	21H51A0512	MANAS CHHATWAL	5	22	27
9	21H51A0513	MANGINA SRI VENKATA SAI	5	21	26
10	21H51A0516	NAGIREDDY ANVITHA	5	25	30
11	21H51A0517	PADALA ANIL KUMAR	5	18	23
12	21H51A0522	SHREYASH SANJEEV KUMAR	5	24	29
13	21H51A0523	SIDDAMSHETTI SUMITH	5	23	28
14	21H51A0527	AKSHAT KALA	5	23	28
15	21H51A0528	ALAVALA KAVYA	5	25	30
16	21H51A0530	BENKI JYOTHIKA	5	25	30
17	21H51A0531	BENKI VARSHITHA RANI	5	25	30
18	21H51A0532	BOLLU HARI CHARHAN	5	23	28
19	21H51A0534	DAVULURI SAI SUJAN	5	25	30
20	21H51A0535	DESHAPATHI SAHITHI	5	24	29
21	21H51A0536	DHULIPALLA VENKATA SAI SIVA	5	24	29
22	21H51A0539	KOLAN SAHASRA REDDY	5	23	28
23	21H51A0543	MANGA TARAKA RATNA YOSHITH	5	24	29
24	21H51A0546	SAPNA TIWARI	5	23	28
25	21H51A0548	THAKUR ABHINAV SINGH	5	23	28
26	21H51A0553	ABBULA VINUTHNA	5	19	24
27	21H51A0557	BUCHENELLI NIKHILESH REDDY	5	17	22
28	21H51A0558	DANDA VENKATA SATHWIK REDDY	5	10	15
29	21H51A0560	GORINTA RAHULU	5	19	24
30	21H51A0561	GUNREDDY AKSHITH REDDY	5	21	26
31	21H51A0564	KODURU PRANATHI	5	23	28
32	21H51A0565	KONDA VISHAL GOUD	5	22	27
33	21H51A0566	KURAKULA SHAILESH	5	20	25
34	21H51A0567	MADIRA SAI RISHITHA	5	23	28
35	21H51A0568	MANURI CHANDU BABU	5	23	28

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
36	21H51A0571	NIMMALA SAI	5	17	22
37	21H51A0575	TUDURU SATHWIK	5	19	24
38	21H51A0576	U NAGA MANASWINI	5	23	28
39	21H51A0577	VARLA RAMAKRISHNA REDDY	5	24	29
40	21H51A0579	AMBATI ROHITH RAJU	5	21	26
41	21H51A0580	BAIRA ANUSHA	5	25	30
42	21H51A0581	GUNNALA AKHILA	5	25	30
43	21H51A0585	KUDUMULA ANVESH REDDY	5	21	26
44	21H51A0587	MANDALOJU VASANTH KUMAR	5	21	26
45	21H51A0588	MOHAMMAD ABDUL KALAM	5	21	26
46	21H51A0589	MOHAMMED MUDASSIR ALI	5	16	21
47	21H51A0590	NALABOLU MOUNIKA	5	22	27
48	21H51A0591	NAMPALLY SIDDHARTHA	5	21	26
49	21H51A0593	PAMULA BEULAH SUPRAGNYA	AB	19	19
50	21H51A0594	PANCHAGNULA VINUTNA	5	23	28
51	21H51A0596	RAGE DAMODHAR	5	14	19
52	21H51A0599	SAI KIRAN B L S	5	17	22
53	21H51A05A0	SHESHAVAMATAM SUCHIT PAUL	5	15	20
54	21H51A05A1	TEEGALA BHANU TEJA REDDY	5	20	25
55	21H51A05A2	VADDI RISHIKA	5	24	29
56	21H51A05A3	YADDANAPUDI VISHNU SRIVATSAVA	5	17	22
57	21H51A05A4	YELDI ARUN	5	17	22
58	21H51A05A7	BAJRANG HARSH SINGH	5	16	21
59	21H51A05A8	BASAR SHYAM SUNDER RAO	5	19	24
60	21H51A05B1	BUNNI SHARANYA	5	23	28
61	21H51A05B2	C J VISHNU PRAKASH	5	18	23
62	21H51A05B3	CHIMMULA SHIVA PRASAD REDDY	5	12	17
63	21H51A05B4	DOLLA RENUKA	5	25	30
64	21H51A05B5	ERUKULA RAJASREE	5	17	22
65	21H51A05B7	HARIKA REDDY GANTA	5	16	21
66	21H51A05B8	INDUPALLI SHARONSUDHA	5	AB	05
67	21H51A05B9	MADULAPURAM SAI YASHWANTH RAJ	5	19	24
68	21H51A05C0	MALLELA SINDHUJA	5	23	28
69	21H51A05C2	RANGU ABHINAV	5	21	26
70	21H51A05C3	RAYABARAPU CHATHURYA	5	21	26
71	21H51A05C5	SEGU JAYA BALA HARSHAVARDHAN	5	25	30
72	21H51A05C8	THATIKONDA AKHILA	5	21	26
73	21H51A05C9	VAKALA KAVYA SAI SUMA SRI	5	22	27
74	21H51A05D1	ANUJ KUMAR	5	23	28
75	21H51A05D2	BACHAWAR VINITHA	5	25	30

Name&Signature of the Faculty : B. Gayathri Gayathri

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Mobile No : 8186823782

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CMR College of Engineering & Technology

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Department of Computer Science and Engineering

MID-II MARKS LIST

Class : III B.Tech. I SEM CSE SECTION-C | A.Y.2023-24

SUBJECT : Computer Networks

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A05C6	SOMU KOTESWARA REDDY	5	17	22
2	21H51A05C7	SUNKAPAKA JOHN	5	12	17
3	21H51A05D0	VALLAMKONDA POOJITHA	5	15	20
4	21H51A05D3	BASHAM RAJU	5	16	21
5	21H51A05D4	BUSSA TEJASWINI	5	18	23
6	21H51A05D5	DADE DINISHA	5	24	29
7	21H51A05D6	DEEKONDA SAKETH	AB	12	12
8	21H51A05E3	MANCHI AKSHAYA	5	17	22
9	21H51A05E4	MOHAMMAD ARSHAD NIZAMI	5	22	27
10	21H51A05F1	P Y GEETHA MADHURI	5	20	25
11	21H51A05F3	SHAIK ILLIYAZ	AB	12	12
12	21H51A05F5	TUSHAR PUNIA	5	23	28
13	21H51A05F8	DODDI SAI PHANI HARI CHANDANA	5	24	29
14	21H51A05F9	GADUGULA KALYANI	5	22	27
15	21H51A05G2	IYLA SNEHARIKA	5	22	27
16	21H51A05G5	KANUGO NESHIT RAJ	5	07	12
17	21H51A05H2	PODDUTURI NITHIN REDDY	5	06	11
18	21H51A05H8	TADEM RAVITEJA	5	12	17
19	21H51A05J8	GUNTHAPALLI MALINI	5	08	13
20	21H51A05J9	GURRAM KRISHNA PRASANTH	AB	22	22
21	21H51A05K3	KODIGANTI SAI KISHORE	AB	00	0
22	21H51A05K8	SEELAMSETTY PRASANNA GAYATHRI	5	24	29
23	21H51A05L1	SRIRAM NAGARAJU	5	20	25
24	21H51A05L7	YALLA TEJASWIK REDDY	5	01	06
25	21H51A05L8	BEHARA SURAJ	AB	19	19
26	21H51A05M0	CHILUKA SAI KARTHIK	5	15	20
27	21H51A05M1	DAMARLA HEMAVATHI	5	18	23
28	21H51A05M4	GIRAVENA ARYA	AB	07	07
29	21H51A05M9	MOKIRALA JHANSI	5	23	28
30	21H51A05N1	NEELA SAI ADITYA	5	05	10
31	21H51A05N3	POTRU SAI NITISH	5	10	15
32	21H51A05N4	PRAHARSHITHA SURAGONI	5	25	30
33	21H51A05N5	PULI PRANEETH GOUD	5	10	15
34	21H51A05P0	TALOORI PRABHU KIRAN	5	10	15
35	21H51A05P2	VAVILLA RAVITEJA	5	25	30

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
36	21H51A05P4	ALLURI SAI SATHWIK REDDY	5	21	26
37	21H51A05P5	ANDE AJAY	5	20	25
38	21H51A05P7	BESTHA NANDA KISHORE	AB	22	22
39	21H51A05P8	CHAVATAPALLI MUKUNDA SRI HASINI	5	14	19
40	21H51A05P9	CHEPYALA SATHWIK REDDY	5	14	19
41	21H51A05Q1	DAGGULA PRASHANTH	5	14	19
42	21H51A05Q2	GAJULA NAVANEETH	5	19	24
43	21H51A05Q3	GUDAPATI NITHIN KUMAR	5	14	19
44	21H51A05R3	PINAPATI ABHISHEK	5	18	23
45	21H51A05R4	RACHAMALLA SAI UJITHA REDDY	5	00	05
46	21H51A05R5	SATTU RAKESH	5	25	30
47	21H51A05R6	SHREYA M	5	07	12
48	21H51A05R7	YERAVELLI RUCHITHA	5	05	10
49	22H55A0515	M. SAI RANJITH REDDY	5	19	24
50	22H55A0516	MAHATHI DESAI	5	15	20
51	22H55A0517	MD TOWHEED	5	12	17
52	22H55A0518	MOHAMMED HANEF	AB	14	14
53	22H55A0519	NAGARAM SHIVA CHAND	5	19	24
54	22H55A0520	NARGE CHARANETEJA	5	13	18
55	22H55A0521	NEELAM RAMYA SARI	5	22	27
56	22H55A0522	PANDAV SONIA	5	23	28
57	22H55A0523	PATHLAVATH SUNITHA	5	22	27
58	22H55A0524	POTTIPALLY DEEPIKA	5	19	24
59	22H55A0525	PULIGANTI MAHENDAR	5	23	28
60	22H55A0526	SARDESHI PRAVEEN KUMAR	5	21	26
61	22H55A0527	VISLAVATH ANITHA	5	21	26

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Department of Computer Science and Engineering

MID-I MARKS LIST

Class : III B.Tech. I SEM CSE **SECTION-D** **A.Y.2023-24**

SUBJECT : Computer Networks (A30514)

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
1	21H51A05D7	DHUDURI SATHVIKA	05	23	28
2	21H51A05D8	GAMPALA SRI DURGA PRABHATH	05	21	26
3	21H51A05D9	GUNDLA VAMSHIDHAR	05	20	25
4	21H51A05E0	KASANAGOTTU AMULYA	05	24	29
5	21H51A05E1	KOTHA VAISHNAVI	05	23	28
6	21H51A05E2	KUMBALA ABHILASH REDDY	05	23	28
7	21H51A05E6	NAKKALA KEERTHANA	05	25	30
8	21H51A05E7	NEELAM BHARATH KUMAR	05	21	26
9	21H51A05E8	NEERUDI HARIPRASAD	05	25	30
10	21H51A05E9	ODURI VEERAMANIKANTA	05	22	27
11	21H51A05F0	OM GUPTA	05	24	29
12	21H51A05F2	ROHAN SACHIN RAKHE	05	21	26
13	21H51A05F4	SHAIK TASNIM	04	19	23
14	21H51A05F6	YARRAMSETTI MADHU VENKATA	05	23	28
15	21H51A05F7	BABBI THAPA	05	18	23
16	21H51A05G0	GUDIPALLY SAI SANJAY	05	25	30
17	21H51A05G1	GUNNA VINAY KUMAR REDDY	05	22	27
18	21H51A05G3	K SRI HARINI	04	20	24
19	21H51A05G4	KANDI SWETHA	04	21	25
20	21H51A05G6	KHANDESH THANU SRI	05	22	27
21	21H51A05G7	MAMIDI VENU GOPAL	05	23	28
22	21H51A05G8	MARAGONI KARTHIKEYA	05	24	29
23	21H51A05G9	NALIMELA JITHIN REDDY	05	20	25
24	21H51A05H1	PATRAYADI RAVI	05	23	28
25	21H51A05H3	POTHARAJU SAI KIRAN	05	24	29
26	21H51A05H5	SHERIKAR RAHUL	05	23	28
27	21H51A05H6	SOMARAJUPALLI THEJASWI	05	24	29
28	21H51A05H7	SUDAM SHIVA	05	17	22
29	21H51A05H9	THALLAM GEETHAN	05	19	24
30	21H51A05J0	TODUPUNURI SHAI PRIYA	05	24	29
31	21H51A05J1	TUMMALA SAHITH	05	16	21
32	21H51A05J2	VIJAYAGIRI AMULYA	05	23	28
33	21H51A05J3	ABHAY PRATAP SINGH	05	17	22
34	21H51A05J4	AYEMON ZEBA	05	21	26
35	21H51A05J5	BONDALA SRINATH	05	20	25
36	21H51A05J6	DODDAPANENI MEGHAN CHOWDARY	05	24	29
37	21H51A05J7	GORANTI SANTHU SATHWIK	05	20	25
38	21H51A05K0	KACHIREDDY JAYASREE	05	24	29
39	21H51A05K1	KAJA SANJEEV KUMAR	05	24	29
40	21H51A05K2	KANTU ANANTHKUMAR	05	21	26

S.No	Roll Number	Name of the Candidate	Assignment (5M)	MID Marks (25 M)	Total (30 M)
41	21H51A05K4	KONDETI VIKRAMREDDY	05	21	26
42	21H51A05K5	KRITIKA KHATRI	05	25	30
43	21H51A05K6	NITYANANDAYYA MATHPATHI	05	20	25
44	21H51A05K9	SHANIGALA VISHNU	05	23	28
45	21H51A05L0	SINDEY ABHIGNA	05	23	28
46	21H51A05L2	SUMESH	05	22	27
47	21H51A05L3	TANNIRU MAHESH	05	22	27
48	21H51A05L4	TUSYAA SREERALA,	05	24	29
49	21H51A05L5	UNI SAILESH	05	24	29
50	21H51A05L6	VAGUAMRI SRINANDHAN	05	23	28
51	21H51A05L9	BHAKE SHASHANK	05	24	29
52	21H51A05M2	DIVYA GAUTAM	05	24	29
53	21H51A05M3	GANGASANI SHANKARSHAN	05	24	29
54	21H51A05M5	GUMMIREDDY SAINATH REDDY	05	25	30
55	21H51A05M6	KALLURI THANMAI	05	21	26
56	21H51A05M7	KATRAVATH MANJULA	05	23	28
57	21H51A05M8	MOHAMMED SAMEER ALI	05	18	23
58	21H51A05N0	NANCHARLA SAI AKSHITHA	05	24	29
59	21H51A05N2	OLIGE RANI	05	25	30
60	21H51A05N6	SAKKERLA RAJ KUMAR	05	21	26
61	21H51A05N7	SALENDRA MANOJ KUMAR	05	20	25
62	21H51A05N8	SHAIK JAVED	05	24	29
63	21H51A05N9	SHRIYA MALANI	05	24	29
64	21H51A05P1	VASURI VINAY KUMAR	05	23	28
65	21H51A05P3	VITTAPUR BINNU REDDY	05	24	29
66	21H51A05P6	BANOTHU DALI HIMASRI	05	A16	05+16=21
67	21H51A05Q0	D GAYATHRI	05	23	28
68	21H51A05Q4	GUDIPUDI DHEERAJ	05	22	27
69	21H51A05Q5	GURRAM SRIKANTH	05	22	27
70	21H51A05Q6	KALVAKUNTA CHANDRASHEKAR	05	21	26
71	21H51A05Q7	KAPU HARSHA VARDAN REDDY	05	24	29
72	21H51A05Q8	KOTTE MOUNIKA	05	24	29
73	21H51A05Q9	MANDA VIGHNESHWARA REDDY	05	14	19
74	21H51A05R0	MANDHUMULA DEEPAK	05	24	29
75	21H51A05R1	PEDDI PRAVALIKA REDDY	05	19	24
76	21H51A05R2	PENDEM YOGITHA	05	23	28
77	21H51A05R8	YESUGARI ADHARSH	05	20	25

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HOD/CSE

Hall Ticket No.

Question Paper Code: A30514

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

B.Tech V Semester Mid-I Examinations October/NOV-2023

(Regulation: CMRCET-R18)

Subject Name: Computer Network Time: 1.30 PM to 3.10 PM

Date: 30-10-2023 AN Branch: CSE Max Marks: 25

PART A

Answer all FIVE questions (Compulsory)
Each question carries TWO marks. 5x2=10M

1 Sketch the TCP/IP reference model

2 Compare the Guided and Unguided Transmission Medium

3 State the LLC sublayer function

4 Interpret the design issues of framing in data link layer.

5 List out the Network Layer routing algorithm.

PART B

Answer ALL questions.
Each question carries FIVE Marks. 3x5=15M

6A Compare the OSI seven Layers and TCP/IP reference model in detail

OR

6B Discuss in detail about Transmission Medium and its types

7A Define Sliding window protocol and examine Go-Back-N ARQ protocol in detail

OR

7B Investigate in detail about the Simple parity check and two dimensional parity check

8A Discuss in detail about the ALOHA protocol

OR

8B Define Routing and Explain any one of the routing protocol

END

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

B.Tech V Semester Mid-II Examinations December -2023

(Regulation: CMRCET-R18)

Subject Name: Computer Networks Time: 1.30 PM to 3.10 PM

Date: 26-12-2023 Branch: CSE Max Marks: 25

PART A

Answer all FIVE questions (Compulsory)

Each question carries TWO marks. 5x2=10M

1 Analyze the Congestion Control

2 Sketch the TCP Header

3 Interpret the Socket addressing

4 State the Elements of Transport Layer Protocol

5 Classify the Domain Name System

PART B

Answer ALL questions.

Each question carries FIVE Marks. 3x5=15M

6. A. Investigate in detail about the Leaky bucket and token bucket algorithm

OR

6. B. Examine the Internetworking concepts in Network layer

7. A. Develop the Connection establishment and release in Transport layer and explain in detail

OR

7. B. Recognize the Transport layer services. Explain the UDP protocol with its Header

8. A. Interpret in detail about E-Mail with its different cases of architecture

OR

8. B. Appraise in detail about Multimedia streaming audio and video

END

Hall Ticket No. | | | | | | | | | | Question Paper Code:A30514

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2 Sketch the TCP Header

3 Interpret the Socket addressing

4 State the Elements of Transport Layer Protocol

5 Classify the Domain Name System

PART B

Answer ALL questions.

Each question carries FIVE Marks. 3x5=15M

6. A. Investigate in detail about the Leaky bucket and token bucket algorithm

OR

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7. A. Develop the Connection establishment and release in Transport layer and explain in detail

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OR

8. B. Appraise in detail about Multimedia streaming audio and video

END

Mid 1 Key paper:

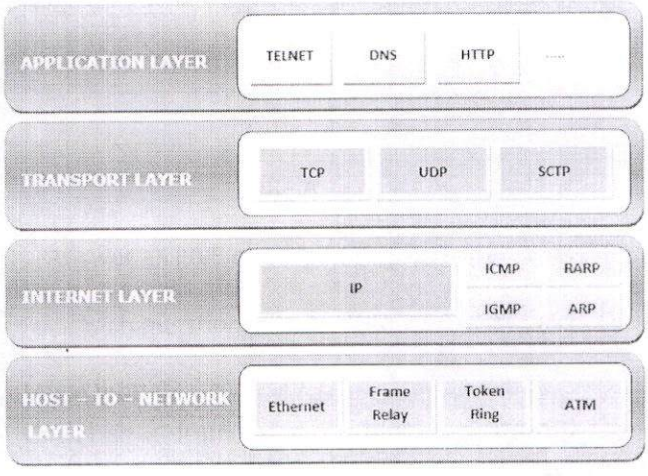
PART A

Answer all FIVE questions (Compulsory)

Each question carries TWO marks.

1. Sketch the TCP/IP reference model?

A. TCP/IP Reference Model is a four-layered suite of communication protocols. It was developed by the DoD (Department of Defence) in the 1960s. It is named after the two main protocols that are used in the model, namely, TCP and IP. **TCP** stands for "**Transmission Control Protocol**" and **IP** stands for "**Internet Protocol**".



2. Compare the Guided and Unguided Transmission Medium?

A.

S.No.	Guided Media	Unguided Media
1.	The guided media is also called wired communication or bounded transmission media.	The unguided media is also called wireless communication or unbounded transmission media.
2	The signal energy propagates through wires in guided media.	The signal energy propagates through the air in unguided media.
3	Guided media is used for point-to-point communication.	Unguided media is generally suited for radio broadcasting in all directions.
4	It is cost-effective.	It is expensive.
5.	Discrete network topologies are formed by the guided media.	Continuous network topologies are formed by the unguided media.

3. State the LLC sublayer function

A. Logical Link Control (LLC) sublayer provides the logic for the data link. Thus, it controls the synchronization, flow control, and error checking functions of the data link layer. Media Access Control (MAC) sublayer provides control for accessing the transmission medium.

4. Interpret the design issues of framing in data link layer.?

A. Design issues with data link layer are :

1. Services provided to the network layer

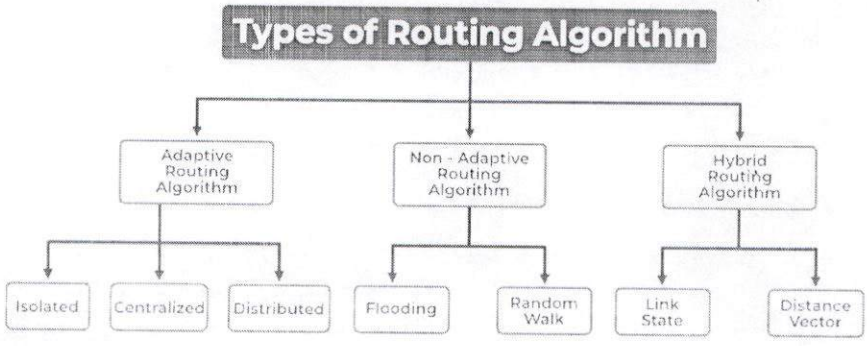
Frame synchronization

Flow control

Error control

5. List out the Network Layer routing algorithm.

A.



PART B

Answer ALL questions.

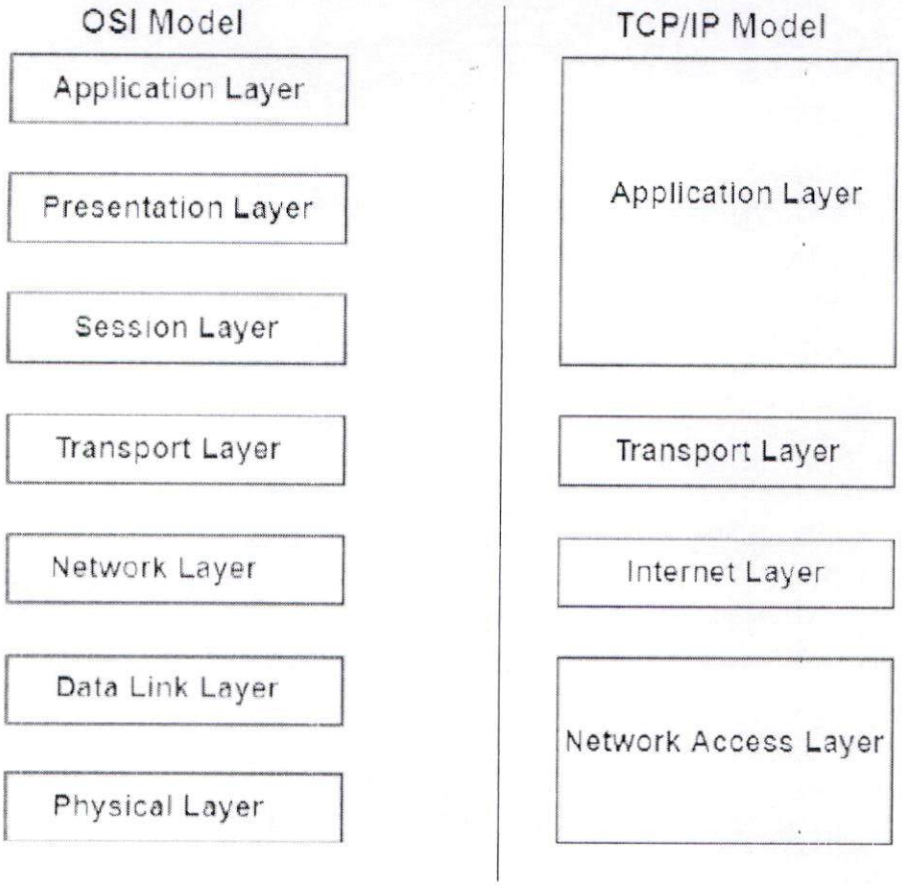
Each question carries FIVE Marks.

6a) Compare the OSI seven Layers and TCP/IP reference model in detail

A.

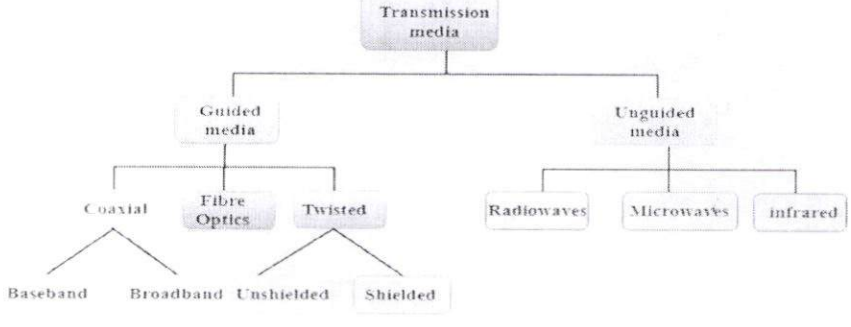
OSI	TCP/IP
OSI represents **Open System Interconnection**.	TCP/IP model represents the Transmission Control Protocol / Internet Protocol.
OSI is a generic, protocol independent standard. It is acting as an interaction gateway between the network	TCP/IP model depends on standard protocols about which the computer network has created. It is a

and the final-user.	connection protocol that assigns the network of hosts over the internet.
The OSI model was developed first, and then protocols were created to fit the network architecture's needs.	The protocols were created first and then built the TCP/IP model.
It provides quality services.	It does not provide quality services.
The OSI model represents defines administration, interfaces and conventions. It describes clearly which layer provides services.	It does not mention the services, interfaces, and protocols.
The protocols of the OSI model are better unseen and can be returned with another appropriate protocol quickly.	The TCP/IP model protocols are not hidden, and we cannot fit a new protocol stack in it.
It is difficult as distinguished to TCP/IP.	It is simpler than OSI.
It provides both connection and connectionless oriented transmission in the network layer; however, only connection-oriented transmission in the transport layer.	It provides connectionless transmission in the network layer and supports connecting and connectionless-oriented transmission in the transport layer.
It uses a vertical approach.	It uses a horizontal approach.
The smallest size of the OSI header is 5 bytes.	The smallest size of the TCP/IP header is 20 bytes.
Protocols are unknown in the OSI model and are returned while the technology modifies.	In TCP/IP, returning protocol is not difficult.



6b) Discuss in detail about Transmission Medium and its types?

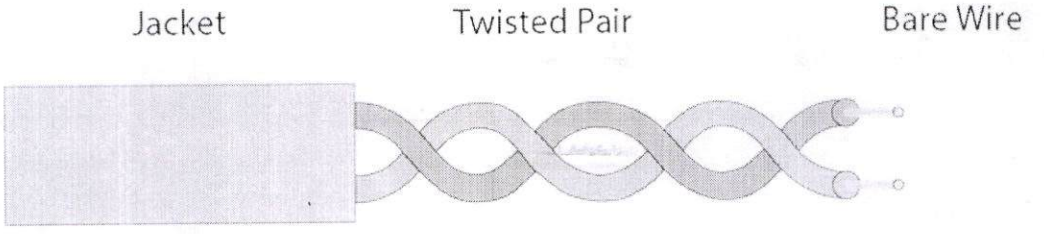
A.



Twisted pair:

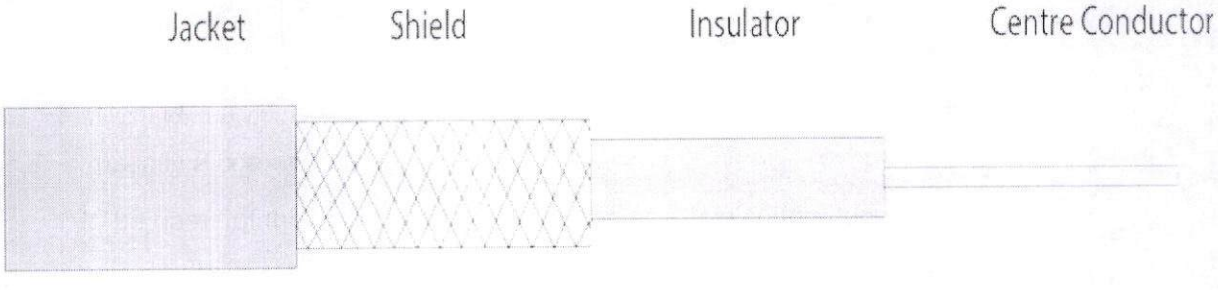
Twisted pair is a physical media made up of a pair of cables twisted with each other. A twisted pair cable is cheap as compared to other transmission media. Installation of the twisted pair cable is easy, and it is a lightweight cable. The frequency range for twisted pair cable is from 0 to 3.5KHz.

A twisted pair consists of two insulated copper wires arranged in a regular spiral pattern.The degree of reduction in noise interference is determined by the number of turns per foot. Increasing the number of turns per foot decreases noise interference.



Coaxial Cable

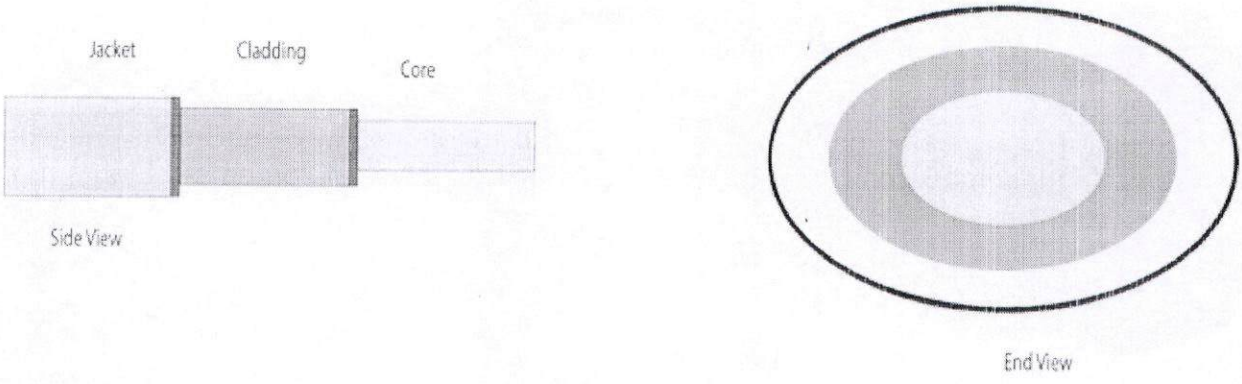
- Coaxial cable is very commonly used transmission media, for example, TV wire is usually a coaxial cable.
- The name of the cable is coaxial as it contains two conductors parallel to each other.
- It has a higher frequency as compared to Twisted pair cable.
- The inner conductor of the coaxial cable is made up of copper, and the outer conductor is made up of copper mesh. The middle core is made up of non-conductive cover that separates the inner conductor from the outer conductor.
- The middle core is responsible for the data transferring whereas the copper mesh prevents from the **EMI**(Electromagnetic interference).



Fibre Optic

- Fibre optic cable is a cable that uses electrical signals for communication.
- Fibre optic is a cable that holds the optical fibres coated in plastic that are used to send the data by pulses of light.
- The plastic coating protects the optical fibres from heat, cold, electromagnetic interference from other types of wiring.
- Fibre optics provide faster data transmission than copper wires.

Diagrammatic representation of fibre optic cable:



7a) Define Sliding window protocol and examine Go-Back-N ARQ protocol in detail?

In Go-Back-N ARQ, **N** is the sender's window size. Suppose we say that Go-Back-3, which means that the three frames can be sent at a time before expecting the acknowledgment from the receiver.

It uses the principle of protocol pipelining in which the multiple frames can be sent before receiving the acknowledgment of the first frame. If we have five frames and the concept is Go-Back-3, which means that the three frames can be sent, i.e., frame no 1, frame no 2, frame no 3 can be sent before expecting the acknowledgment of frame no 1.

In Go-Back-N ARQ, the frames are numbered sequentially as Go-Back-N ARQ sends the multiple frames at a time that requires the numbering approach to distinguish the frame from another frame, and these numbers are known as the sequential numbers.

The number of frames that can be sent at a time totally depends on the size of the sender's window. So, we can say that 'N' is the number of frames that can be sent at a time before receiving the acknowledgment from the receiver.

If the acknowledgment of a frame is not received within an agreed-upon time period, then all the frames available in the current window will be retransmitted. Suppose we have sent the frame no 5, but we didn't receive the acknowledgment of frame no 5, and the current window is holding three frames, then these three frames will be retransmitted.

The sequence number of the outbound frames depends upon the size of the sender's window. Suppose the sender's window size is 2, and we have ten frames to send, then the sequence numbers will not be 1,2,3,4,5,6,7,8,9,10. Let's understand through an example.

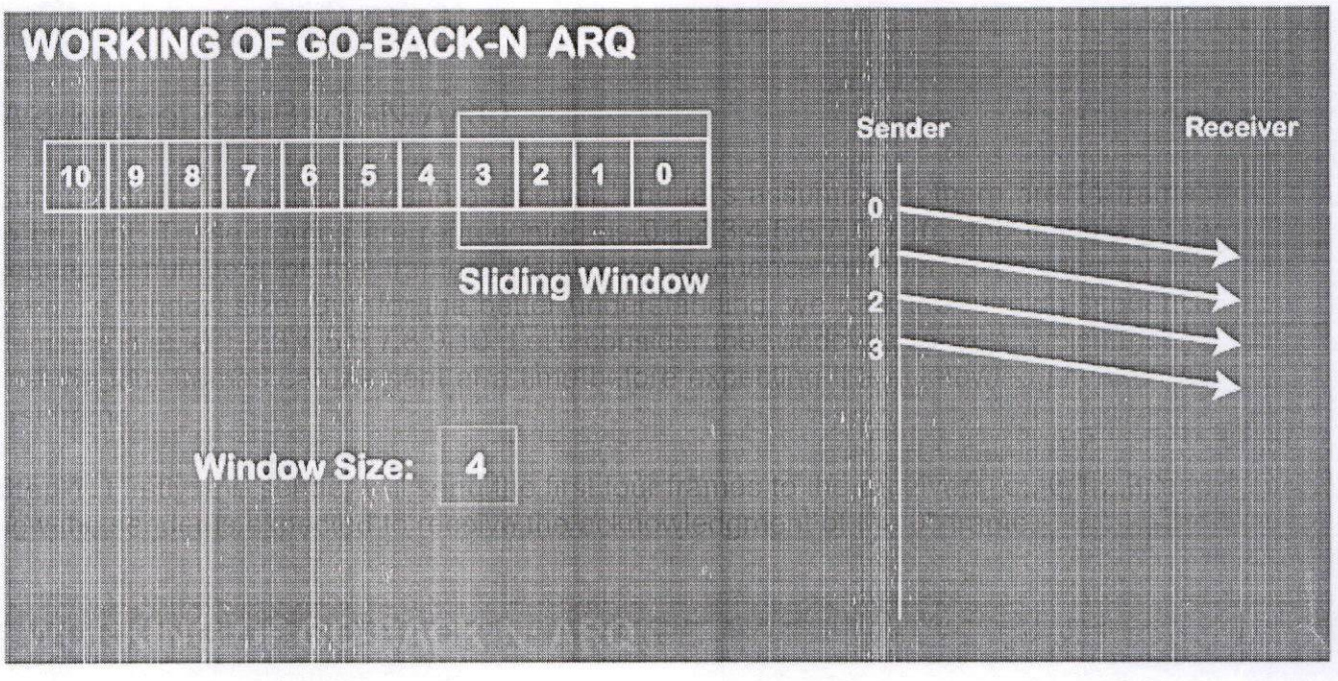
- N is the sender's window size.
- If the size of the sender's window is 4 then the sequence number will be 0,1,2,3,0,1,2,3,0,1,2, and so on.

The number of bits in the sequence number is 2 to generate the binary sequence 00,01,10,11.

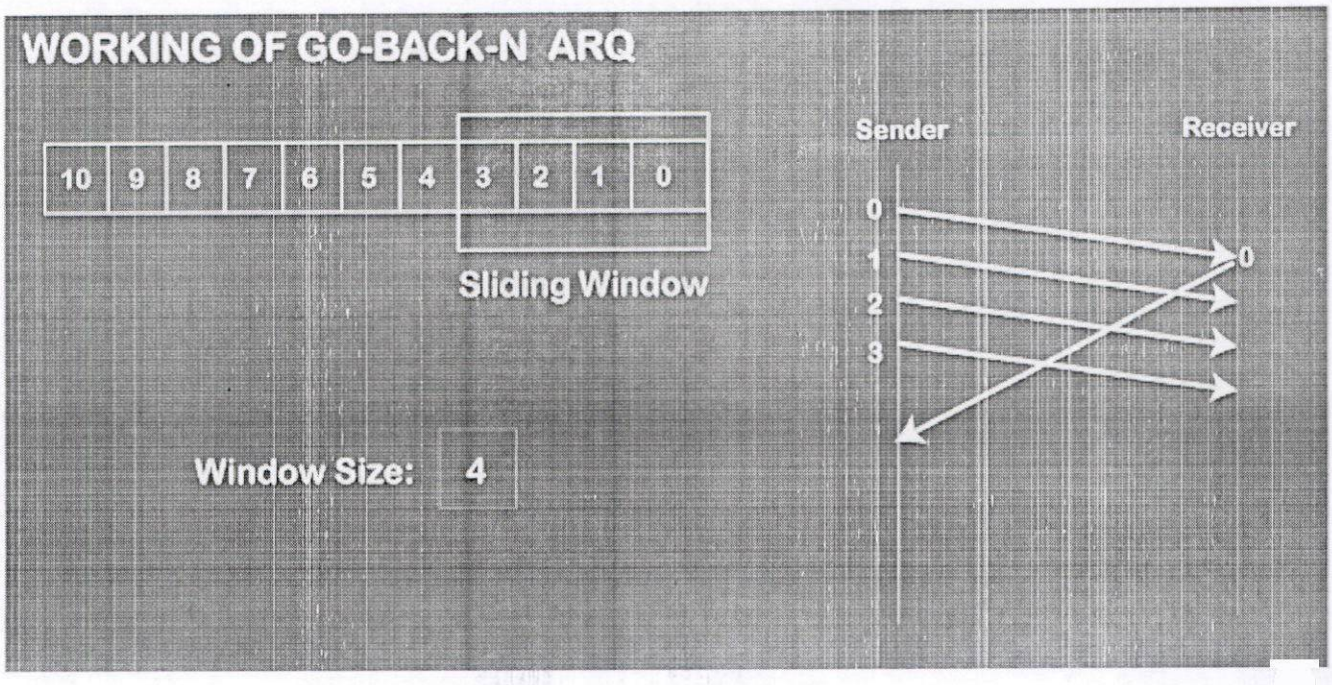
Working of Go-Back-N ARQ

Suppose there are a sender and a receiver, and let's assume that there are 11 frames to be sent. These frames are represented as 0,1,2,3,4,5,6,7,8,9,10, and these are the sequence numbers of the frames. Mainly, the sequence number is decided by the sender's window size. But, for the better understanding, we took the running sequence numbers, i.e., 0,1,2,3,4,5,6,7,8,9,10. Let's consider the window size as 4, which means that the four frames can be sent at a time before expecting the acknowledgment of the first frame.

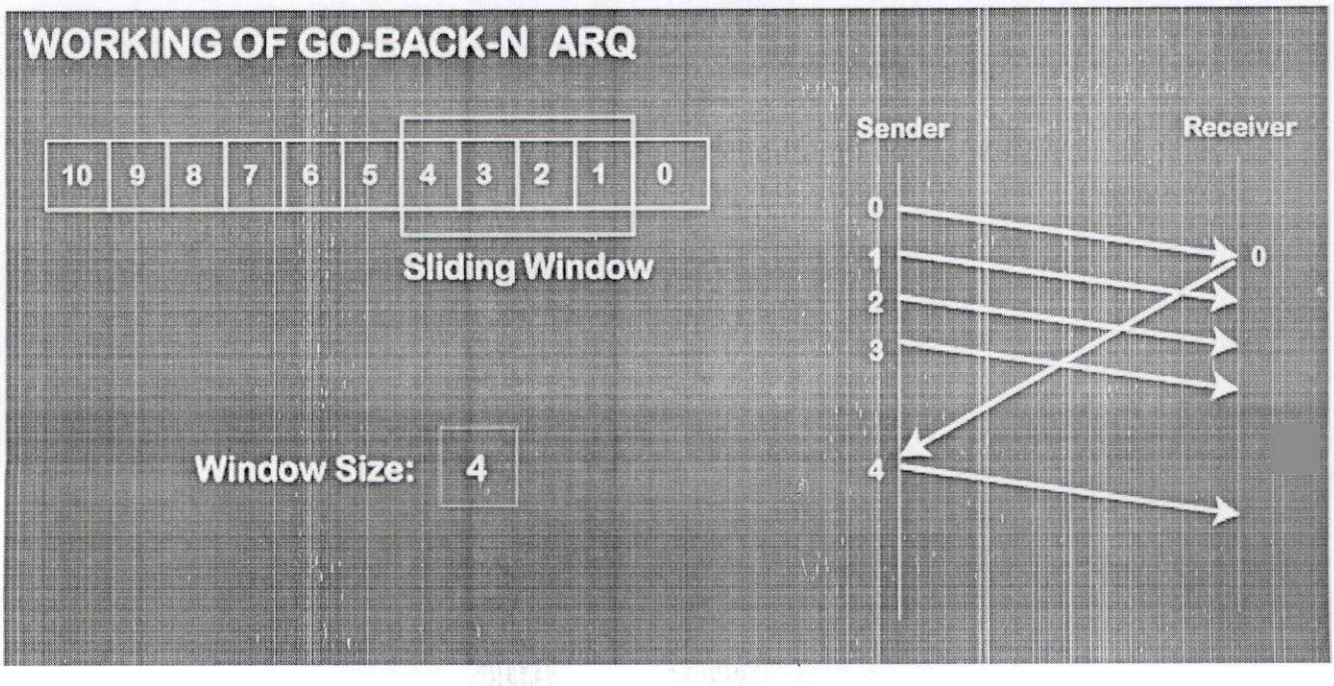
Step 1: Firstly, the sender will send the first four frames to the receiver, i.e., 0,1,2,3, and now the sender is expected to receive the acknowledgment of the 0th frame.



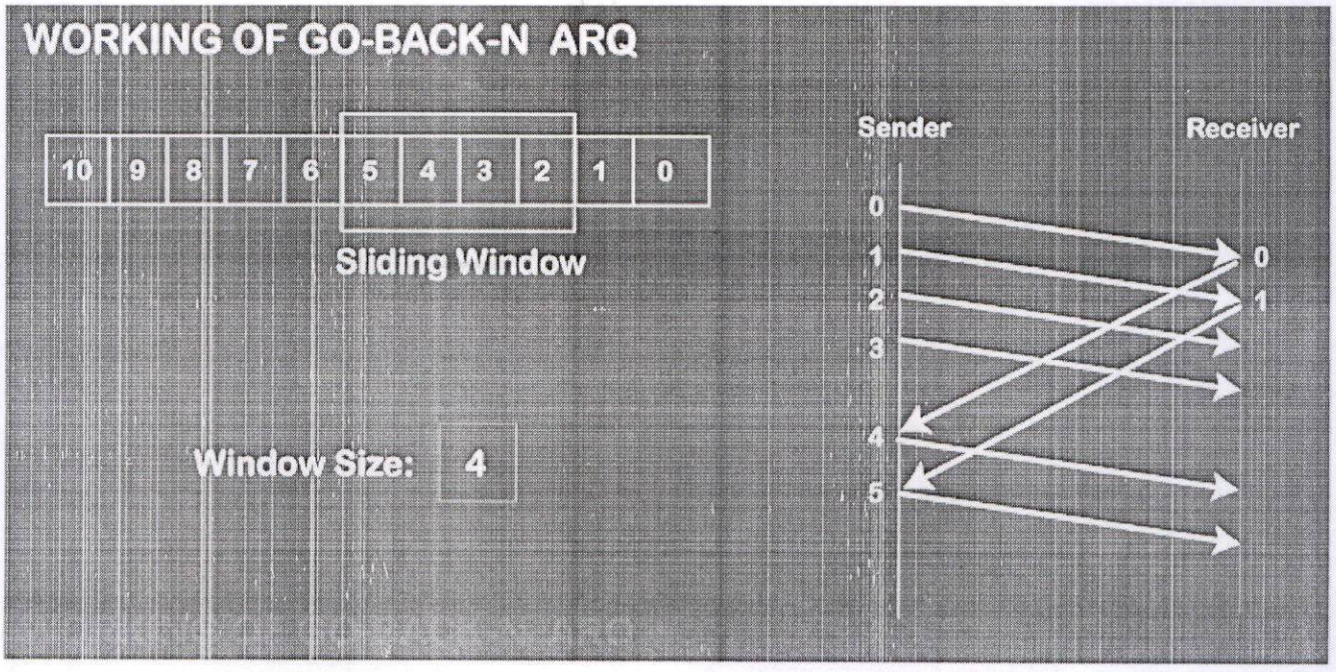
Let's assume that the receiver has sent the acknowledgment for the 0 frame, and the receiver has successfully received it.



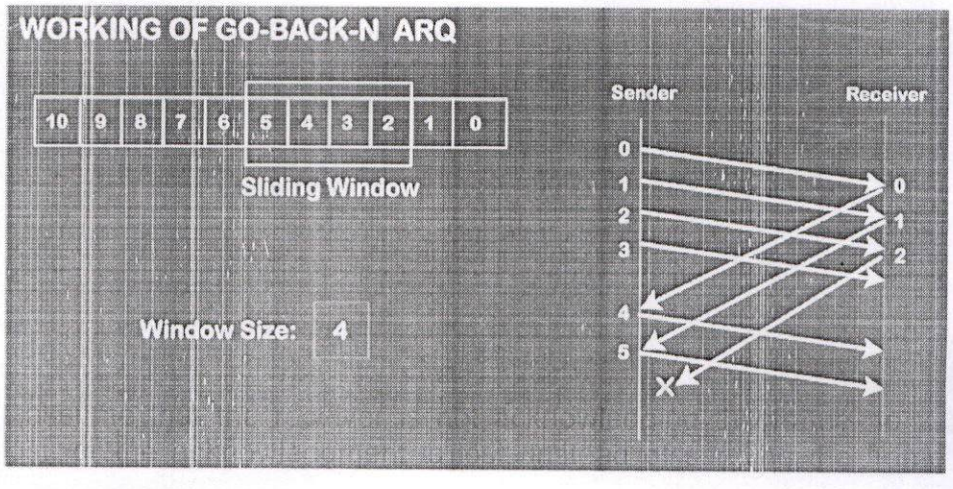
The sender will then send the next frame, i.e., 4, and the window slides containing four frames (1,2,3,4).

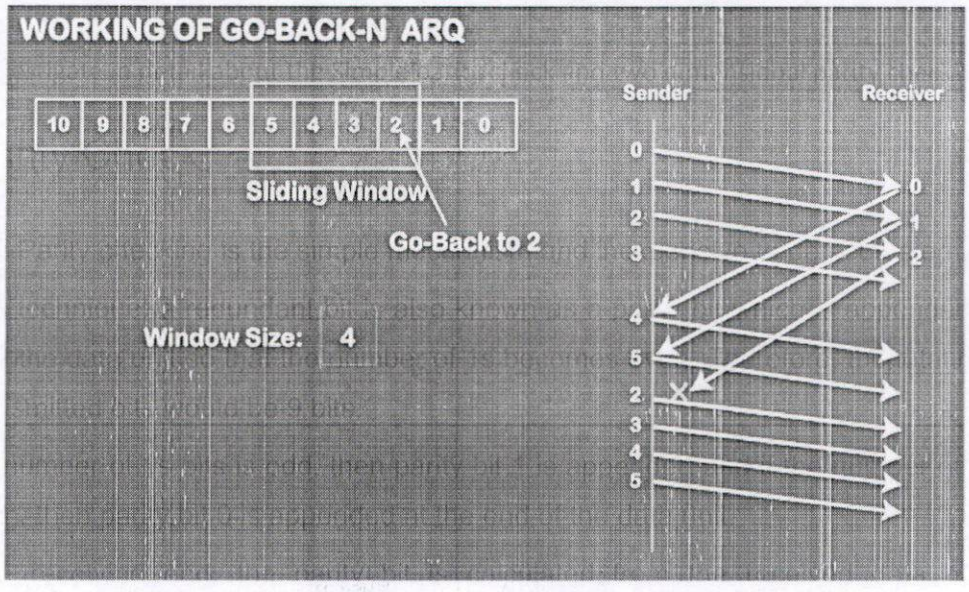


The receiver will then send the acknowledgment for the frame no 1. After receiving the acknowledgment, the sender will send the next frame, i.e., frame no 5, and the window will slide having four frames (2,3,4,5).



Now, let's assume that the receiver is not acknowledging the frame no 2, either the frame is lost, or the acknowledgment is lost. Instead of sending the frame no 6, the sender Go-Back to 2, which is the first frame of the current window, retransmits all the frames in the current window, i.e., 2,3,4,5.

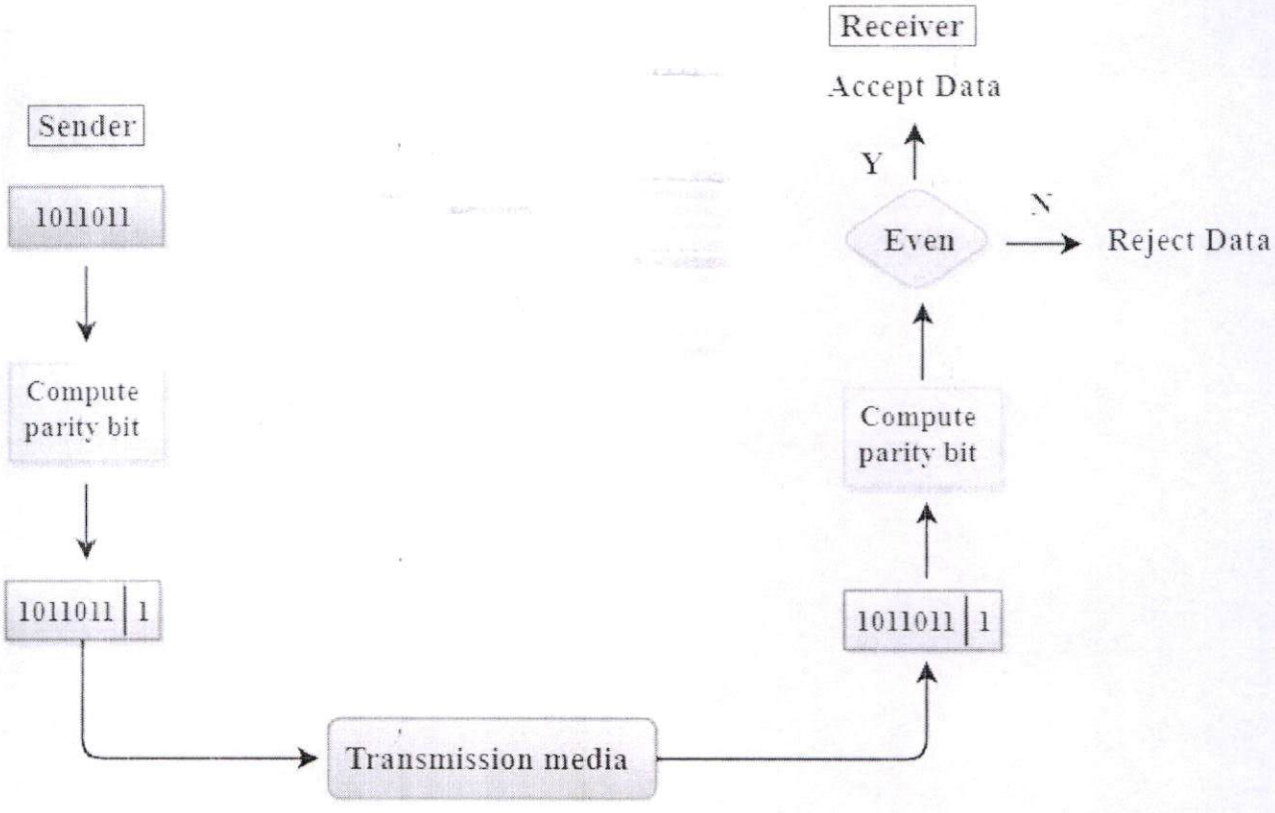




7b) Investigate in detail about the Simple parity check and two dimensional parity check?

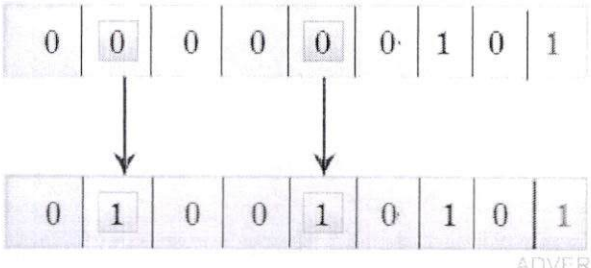
Single Parity Check

- Single Parity checking is the simple mechanism and inexpensive to detect the errors.
- In this technique, a redundant bit is also known as a parity bit which is appended at the end of the data unit so that the number of 1s becomes even. Therefore, the total number of transmitted bits would be 9 bits.
- If the number of 1s bits is odd, then parity bit 1 is appended and if the number of 1s bits is even, then parity bit 0 is appended at the end of the data unit.
- At the receiving end, the parity bit is calculated from the received data bits and compared with the received parity bit.
- This technique generates the total number of 1s even, so it is known as even-parity checking.



Drawbacks Of Single Parity Checking

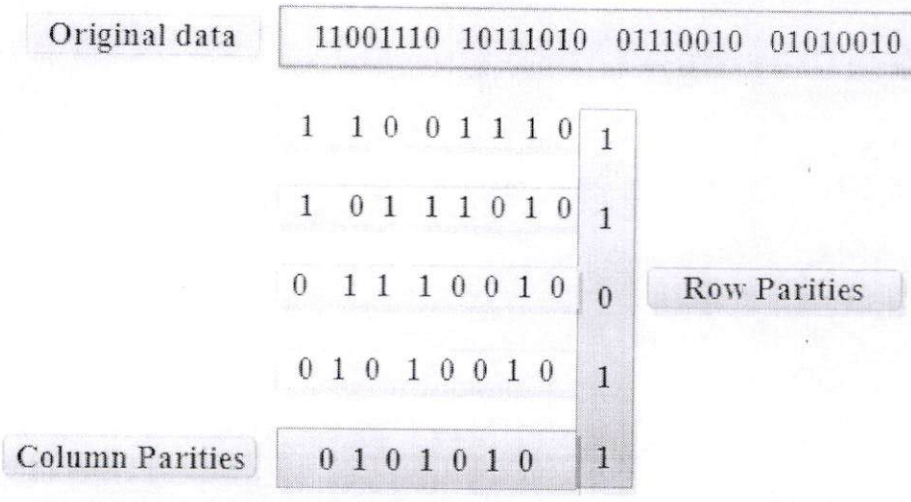
- It can only detect single-bit errors which are very rare.
- If two bits are interchanged, then it cannot detect the errors.



Two-Dimensional Parity Check

- Performance can be improved by using **Two-Dimensional Parity Check** which organizes the data in the form of a table.
- Parity check bits are computed for each row, which is equivalent to the single-parity check.
- In Two-Dimensional Parity check, a block of bits is divided into rows, and the redundant row of bits is added to the whole block.

- At the receiving end, the parity bits are compared with the parity bits computed from the received data.



Drawbacks Of 2D Parity Check

- If two bits in one data unit are corrupted and two bits exactly the same position in another data unit are also corrupted, then 2D Parity checker will not be able to detect the error.
- This technique cannot be used to detect the 4-bit errors or more in some cases.

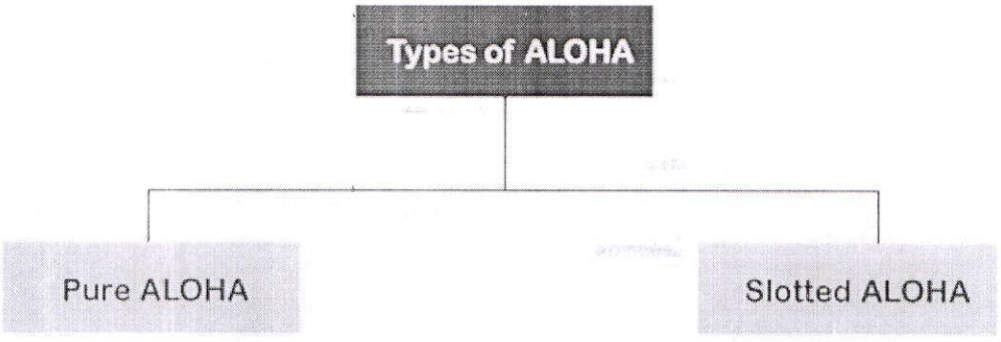
8a) Discuss in detail about the ALOHA protocol?

ALOHA Random Access Protocol

It is designed for wireless LAN (Local Area Network) but can also be used in a shared medium to transmit data. Using this method, any station can transmit data across a network simultaneously when a data frameset is available for transmission.

Aloha Rules

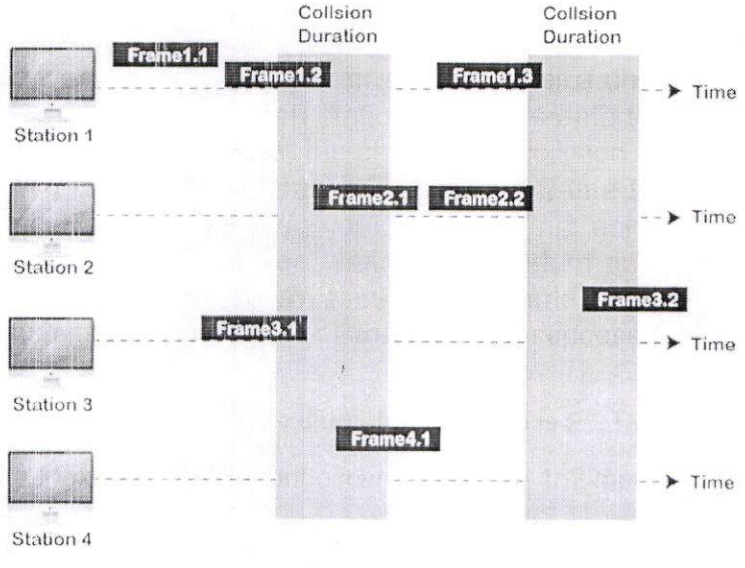
1. Any station can transmit data to a channel at any time.
2. It does not require any carrier sensing.
3. Collision and data frames may be lost during the transmission of data through multiple stations.
4. Acknowledgment of the frames exists in Aloha. Hence, there is no collision detection.
5. It requires retransmission of data after some random amount of time.



Pure Aloha

Whenever data is available for sending over a channel at stations, we use Pure Aloha. In pure Aloha, when each station transmits data to a channel without checking whether the channel is idle or not, the chances of collision may occur, and the data frame can be lost. When any station transmits the data frame to a channel, the pure Aloha waits for the receiver's acknowledgment. If it does not acknowledge the receiver end within the specified time, the station waits for a random amount of time, called the backoff time (Tb). And the station may assume the frame has been lost or destroyed. Therefore, it retransmits the frame until all the data are successfully transmitted to the receiver.

1. The total vulnerable time of pure Aloha is 2 * Tfr.
2. Maximum throughput occurs when G = 1/ 2 that is 18.4%.
3. Successful transmission of data frame is S = G * e ^ - 2 G.



Frames in Pure ALOHA

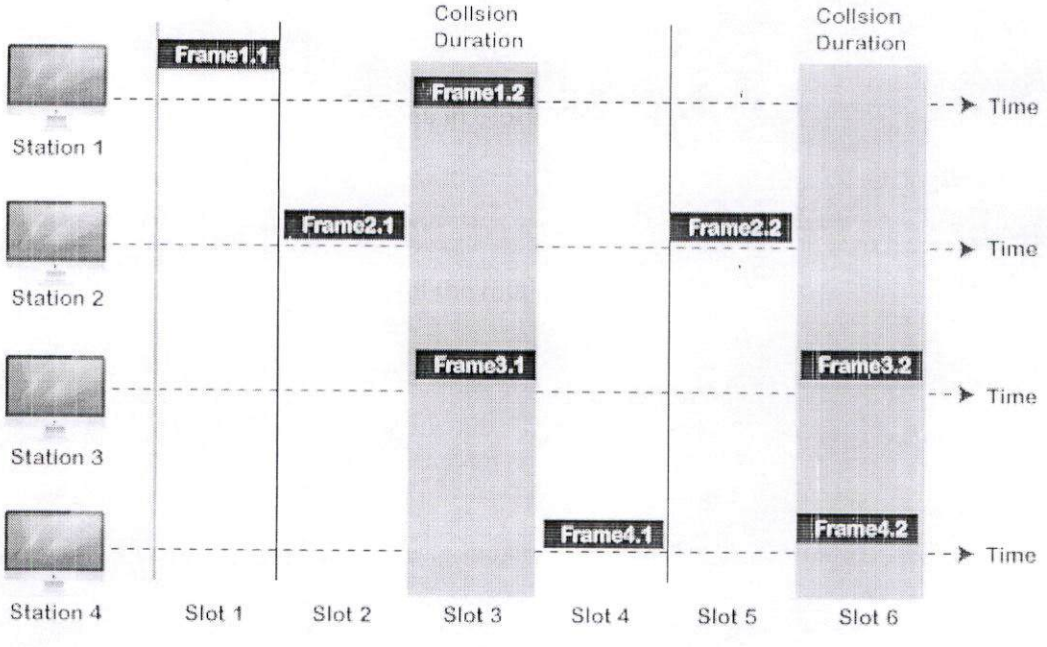
As we can see in the figure above, there are four stations for accessing a shared channel and transmitting data frames. Some frames collide because most stations send their frames at the same time. Only two frames, frame 1.1 and frame 2.2, are successfully transmitted to the receiver end. At the same time, other frames are lost or

destroyed. Whenever two frames fall on a shared channel simultaneously, collisions can occur, and both will suffer damage. If the new frame's first bit enters the channel before finishing the last bit of the second frame. Both frames are completely finished, and both stations must retransmit the data frame.

Slotted Aloha

The slotted Aloha is designed to overcome the pure Aloha's efficiency because pure Aloha has a very high possibility of frame hitting. In slotted Aloha, the shared channel is divided into a fixed time interval called **slots**. So that, if a station wants to send a frame to a shared channel, the frame can only be sent at the beginning of the slot, and only one frame is allowed to be sent to each slot. And if the stations are unable to send data to the beginning of the slot, the station will have to wait until the beginning of the slot for the next time. However, the possibility of a collision remains when trying to send a frame at the beginning of two or more station time slot.

1. Maximum throughput occurs in the slotted Aloha when G = 1 that is 37%.
2. The probability of successfully transmitting the data frame in the slotted Aloha is S = G * e ^ - 2 G.
3. The total vulnerable time required in slotted Aloha is Tfr.



Frames in Slotted ALOHA

8 b) Define Routing and Explain any one of the routing protocol?

A. **Distance-vector routing (DVR)** protocol requires that a router inform its neighbors of topology changes periodically. Historically known as the old ARPANET routing algorithm (or known as Bellman-Ford algorithm). **Bellman Ford Basics** – Each router maintains a Distance Vector table containing the distance between itself and ALL possible destination nodes. Distances,based on a chosen metric, are computed using information from the neighbors' distance vectors.

Information kept by DV router -

- Each router has an ID
- Associated with each link connected to a router,
- there is a link cost (static or dynamic).
- Intermediate hops

Distance Vector Table Initialization -

- Distance to itself = 0
- Distance to ALL other routers = infinity number.

Distance Vector Algorithm –

1. A router transmits its distance vector to each of its neighbors in a routing packet.
2. Each router receives and saves the most recently received distance vector from each of its neighbors.
3. A router recalculates its distance vector when:
   - It receives a distance vector from a neighbor containing different information than before.
   - It discovers that a link to a neighbor has gone down.

The DV calculation is based on minimizing the cost to each destination

Dx(y) = Estimate of least cost from x to y

C(x,v) = Node x knows cost to each neighbor v

Dx = [Dx(y): y ? N] = Node x maintains distance vector

Node x also maintains its neighbors' distance vectors

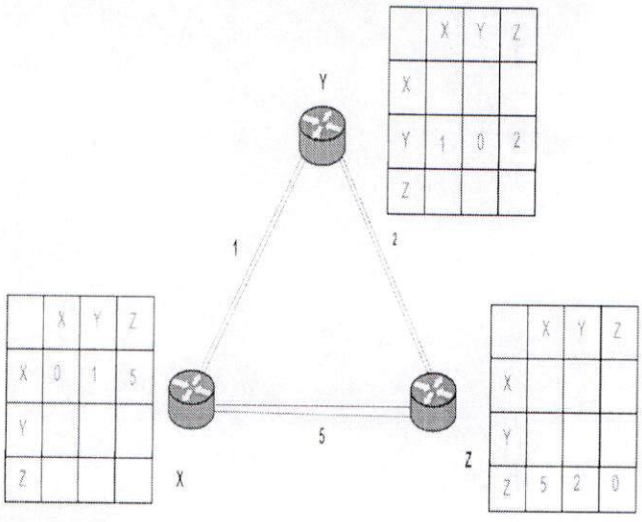
– For each neighbor v, x maintains Dv = [Dv(y): y ? N]

Note –

- From time-to-time, each node sends its own distance vector estimate to neighbors.
- When a node x receives new DV estimate from any neighbor v, it saves v's distance vector and it updates its own DV using B-F equation:
- Dx(y) = min { C(x,v) + Dv(y), Dx(y) } for each node y ? N

Example – Consider 3-routers X, Y and Z as shown in figure. Each router have their routing

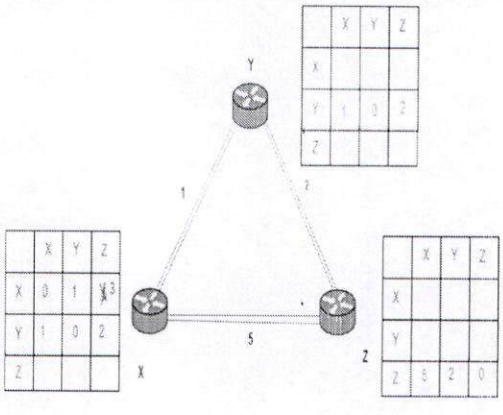
table. Every routing table will contain distance to the destination nodes.



Consider router X , X will share it routing table to neighbors and neighbors will share it routing table to it to X and distance from node X to destination will be calculated using bellmen- ford equation.

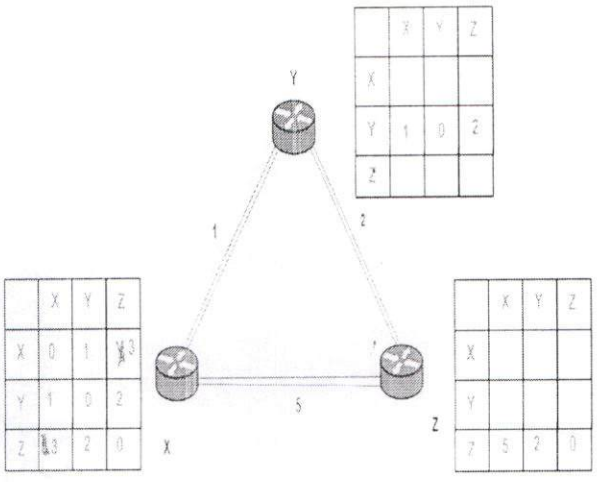
$Dx(y) = \min \{ C(x,v) + Dv(y) \}$ for each node y ? N

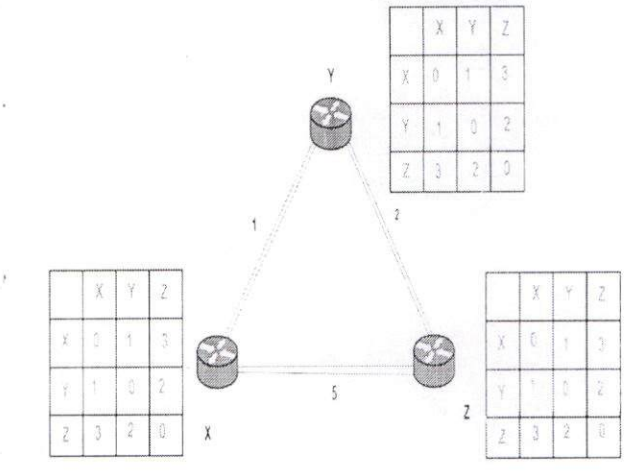
As we can see that distance will be less going from X to Z when Y is intermediate node(hop)



so it will be update in routing table X.

Similarly for Z also –





Finally the routing table for all –

Advantages of Distance Vector routing –

- It is simpler to configure and maintain than link state routing.

Disadvantages of Distance Vector routing –

- It is slower to converge than link state.
- It is at risk from the count-to-infinity problem.
- It creates more traffic than link state since a hop count change must be propagated to all routers and processed on each router. Hop count updates take place on a periodic basis, even if there are no changes in the network topology, so bandwidth-wasting broadcasts still occur.
- For larger networks, distance vector routing results in larger routing tables than link state since each router must know about all other routers. This can also lead to congestion on WAN links.

MID –II Key Paper

PART A

Answer all FIVE questions (Compulsory)

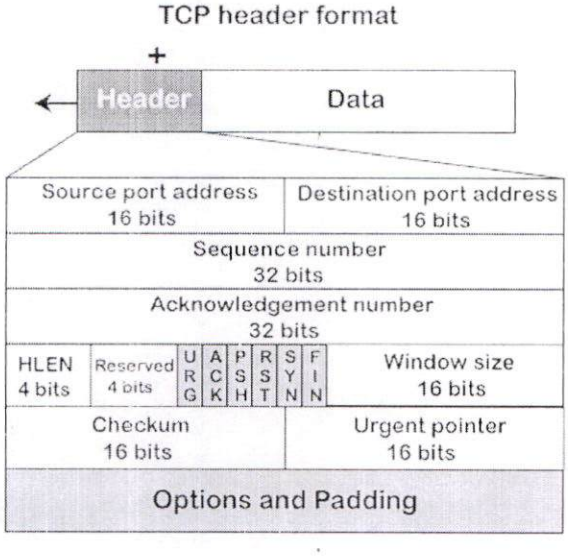
Each question carries TWO marks.

1. Analyze the Congestion Control?

A. Congestion Control is a mechanism that controls the entry of data packets into the network, enabling a better use of a shared network infrastructure and avoiding congestive collapse. Congestive-Avoidance Algorithms (CAA) are implemented at the TCP layer as the mechanism to avoid congestive collapse in a network.

2. Sketch the TCP Header

TCP Header Format



3. Interpret the Socket addressing?

A. A **socket** is one endpoint of a **two way** communication link between two programs running on the network. The socket mechanism provides a means of inter-process

communication (IPC) by establishing named contact points between which the communication take place.

Like 'Pipe' is used to create pipes and sockets is created using **'socket'** system call. The socket provides bidirectional **FIFO** Communication facility over the network. A socket connecting to the network is created at each end of the communication. Each socket has a specific address. This address is composed of an IP address and a port number.

4. State the Elements of Transport Layer Protocol

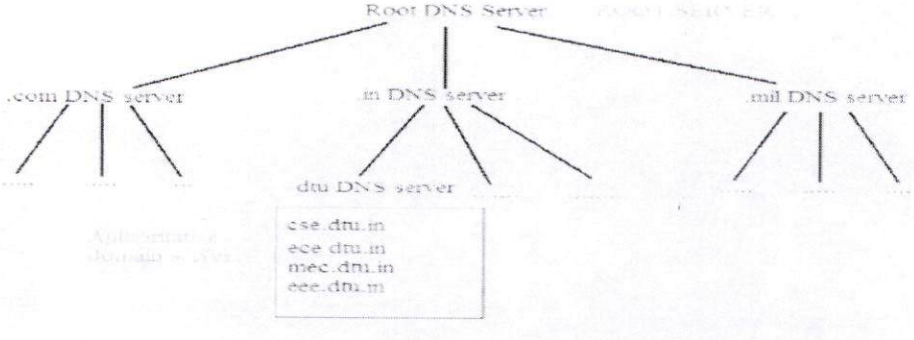
A. Elements of transport protocols

- Transport Data Link.
- Addressing.
- Establishing a connection.
- Releasing a connection.
- Flow control and buffering.
- Multiplexing.
- Crash recovery.

5. Classify the Domain Name System

A. Domain Name System (DNS) is a hostname for **IP address** translation service. DNS is a distributed database implemented in a hierarchy of name servers. It is an application layer protocol for message exchange between clients and servers. It is required for the functioning of the Internet.

1. **Generic domains:** .com(commercial), .edu(educational), .mil(military), .org(nonprofit organization), .net(similar to commercial) all these are generic domains.
1. **Country domain:** .in (India) .us .uk
1. **Inverse domain:** if we want to know what is the domain name of the website. Ip to domain name mapping. So DNS can provide both the mapping for example to find the IP addresses of geeksforgeeks.org then we have to type



PART B

Answer ALL questions.

Each question carries FIVE Marks.

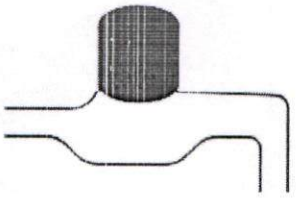
6 a) Investigate in detail about the Leaky bucket and token bucket algorithm

A. There are 2 types of traffic shaping algorithms:

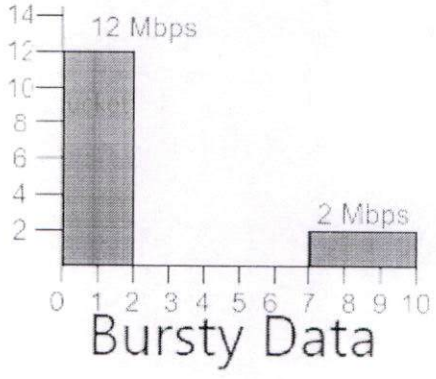
1. Leaky Bucket
2. Token Bucket

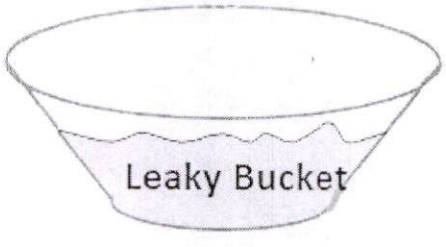
Suppose we have a bucket in which we are pouring water, at random points in time, but we have to get water at a fixed rate, to achieve this we will make a hole at the bottom of the bucket. This will ensure that the water coming out is at some fixed rate, and also if the bucket gets full, then we will stop pouring water into it.

The input rate can vary, but the output rate remains constant. Similarly, in networking, a technique called leaky bucket can smooth out bursty traffic. Bursty chunks are stored in the bucket and sent out at an average rate.

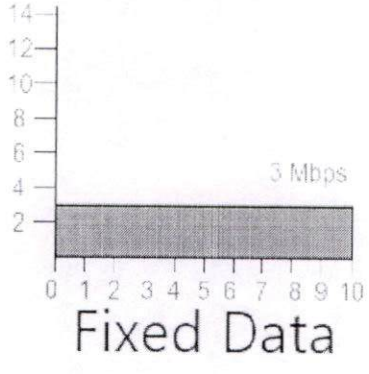


Bursty Flow





Fixed Flow



In the above figure, we assume that the network has committed a bandwidth of 3 Mbps for a host. The use of the leaky bucket shapes the input traffic to make it conform to this commitment. In the above figure, the host sends a burst of data at a rate of 12 Mbps for 2s, for a total of 24 Mbits of data. The host is silent for 5 s and then sends data at a rate of 2 Mbps for

3 s, for a total of 6 Mbits of data. In all, the host has sent 30 Mbits of data in 10 s. The leaky bucket smooths out the traffic by sending out data at a rate of 3 Mbps during the same 10 s.

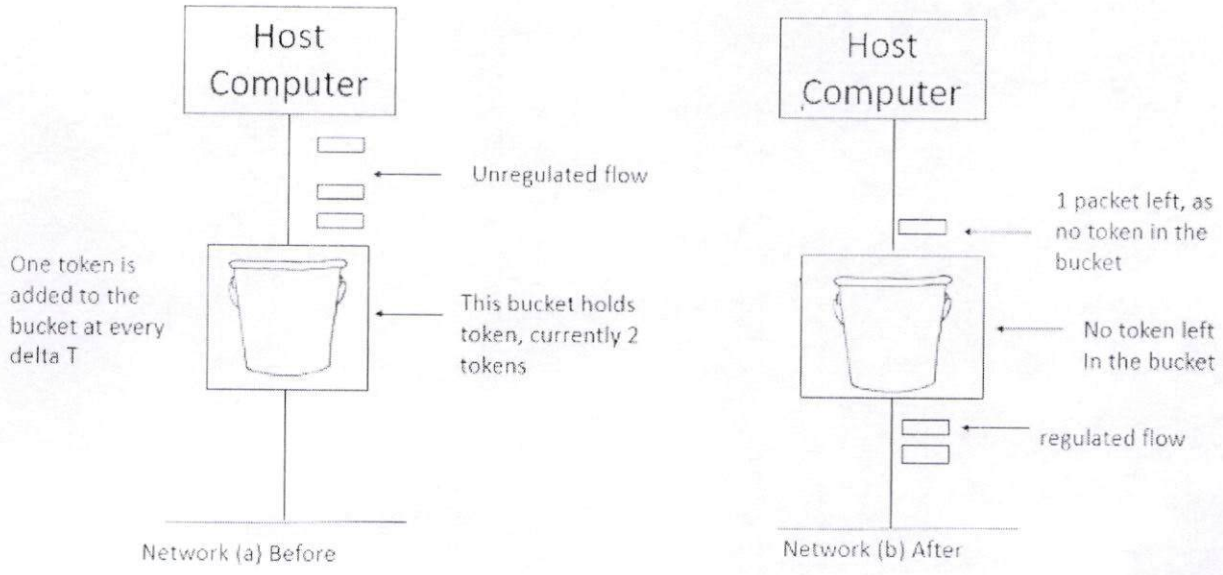
Without the leaky bucket, the beginning burst may have hurt the network by consuming more bandwidth than is set aside for this host. We can also see that the leaky bucket may prevent congestion.

A simple leaky bucket algorithm can be implemented using FIFO queue. A FIFO queue holds the packets. If the traffic consists of fixed-size packets (e.g., cells in ATM networks), the process removes a fixed number of packets from the queue at each tick of the clock. If the traffic consists of variable-length packets, the fixed output rate must be based on the number of bytes or bits.

Token bucket algorithm is one of the techniques for congestion control algorithms. When too many packets are present in the network it causes packet delay and loss of packet which degrades the performance of the system. This situation is called congestion.

Example

Let us understand the Token Bucket Algorithm with an example –



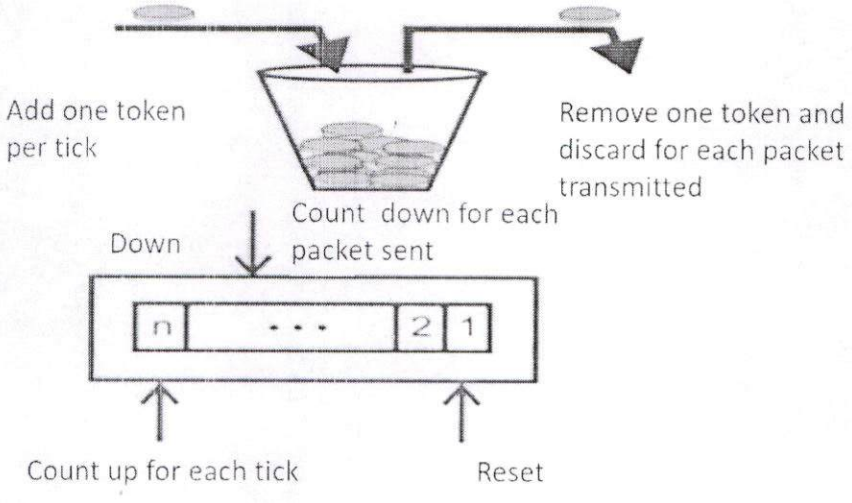
In figure (a) the bucket holds two tokens, and three packets are waiting to be sent out of the interface.

In Figure (b) two packets have been sent out by consuming two tokens, and 1 packet is still left.

When compared to Leaky bucket the token bucket algorithm is less restrictive that means it allows more traffic. The limit of busyness is restricted by the number of tokens available in the bucket at a particular instant of time.

The implementation of the token bucket algorithm is easy – a variable is used to count the tokens. For every t seconds the counter is incremented and then it is decremented whenever a packet is sent. When the counter reaches zero, no further packet is sent out.

This is shown in below given diagram –



6 b) Examine the Internetworking concepts in Network layer

To enable communication, every individual network node or phase is designed with a similar protocol or communication logic, that is Transfer Control Protocol (TCP) or Internet Protocol (IP). Once a network communicates with another network having constant communication procedures, it's called Internetworking. Internetworking was designed to resolve the matter of delivering a packet of information through many links.

There is a minute difference between extending the network and Internetworking. Merely exploitation of either a switch or a hub to attach 2 local area networks is an extension of LAN whereas connecting them via the router is an associate degree example of Internetworking. Internetworking is enforced in Layer three (Network Layer) of the OSI-ISO model. The foremost notable example of internetworking is the Internet.

There is chiefly 3 units of Internetworking:

1. Extranet
2. Intranet

3. Internet

Intranets and extranets might or might not have connections to the net. If there is a connection to the net, the computer network or extranet area unit is usually shielded from being accessed from the net if it is not authorized. The net isn't thought-about to be a section of the computer network or extranet, though it should function as a portal for access to parts of the associate degree extranet.

1. **Extranet** – It's a network of the internetwork that's restricted in scope to one organization or entity however that additionally has restricted connections to the networks of one or a lot of different sometimes, however not essential. It's the very lowest level of Internetworking, usually enforced in an exceedingly personal area. Associate degree extranet may additionally be classified as a Man, WAN, or different form of network however it cannot encompass one local area network i.e. it should have a minimum of one reference to associate degree external network.
2. **Intranet** – This associate degree computer network could be a set of interconnected networks, which exploits the Internet Protocol and uses IP-based tools akin to web browsers and FTP tools, that are underneath the management of one body entity. That body entity closes the computer network to the remainder of the planet and permits solely specific users. Most typically, this network is the internal network of a corporation or different enterprise. An outsized computer network can usually have its own internet server to supply users with browsable data.
3. **Internet** – A selected Internetworking, consisting of a worldwide interconnection of governmental, academic, public, and personal networks based mostly upon the Advanced analysis comes Agency Network (ARPANET) developed by ARPA of the U.S. Department of Defense additionally home to the World Wide Web (WWW) and cited as the 'Internet' to differentiate from all different generic Internetworks. Participants within the web, or their service suppliers, use IP Addresses obtained from address registries that manage assignments.

7 a) Develop the Connection establishment and release in Transport layer and explain in detail

TCP is a connection-oriented protocol, which means that it first establishes the connection between the sender and receiver in the form of a **handshake**: After both the connections are verified, it begins transmitting packets. It makes the transmission process error-free and ensures the delivery of data. It is an important part of the communication protocols used to interconnect network devices on the internet. The whole internet system relies on this network.

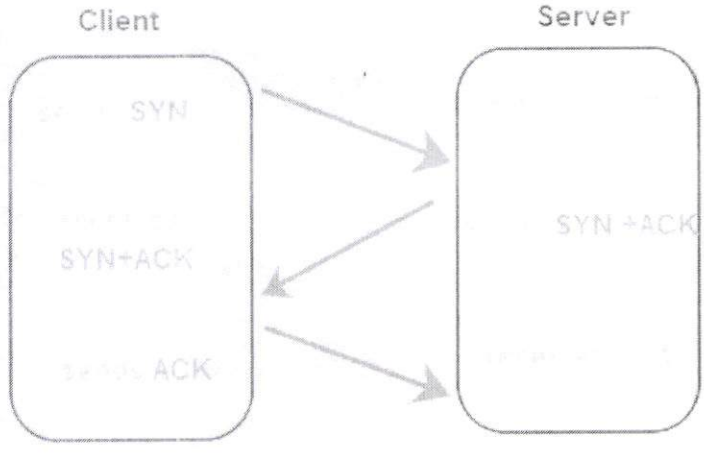
TCP is one of the most common protocols that ensure **end-to-end** delivery. It guarantees the security and integrity of the data being transmitted. It always establishes a secure connection between the sender and receiver. The transmitter is the **server**, and the receiver is known as the **client**. We can also say that the data transmission occurs between the server and client. Hence, TCP is used in most of the high-level protocols, such as **FTP** (File Transfer Protocol), **HTTP** (Hyper Text Transfer Protocol), and **SMTP** (Simple Mai Transfer Protocol).

TCP Connection (A 3-way handshake)

Handshake refers to the process to establish connection between the client and server. Handshake is simply defined as the process to establish a communication link. To transmit a packet, TCP needs a three way handshake before it starts sending data. The reliable communication in TCP is termed as **PAR** (Positive Acknowledgement Re-transmission). When a sender sends the data to the receiver, it requires a positive acknowledgement from the receiver confirming the arrival of data. If the acknowledgement has not reached the sender, it needs to resend that data. The positive acknowledgement from the receiver establishes a successful connection.

Here, the server is the server and client is the receiver. The above diagram shows 3 steps for successful connection. A 3-way handshake is commonly known as SYN-SYN-ACK and requires both the client and server response to exchange the data. SYN means **synchronize Sequence Number** and ACK means **acknowledgment**. Each step is a type of handshake between the sender and the receiver.

The diagram of a successful TCP connection showing the three handshakes is shown below:



The three handshakes are discussed in the below steps:

Step 1: SYN

SYN is a segment sent by the client to the server. It acts as a **connection request** between the client and server. It informs the server that the client wants to establish a connection. Synchronizing sequence numbers also helps synchronize sequence numbers sent between any two devices, where the same SYN segment asks for the sequence number with the connection request.

Step 2: SYN-ACK

It is an SYN-ACK segment or an SYN + ACK segment sent by the server. The ACK segment informs the client that the server has received the connection request and it is ready to build the

connection. The SYN segment informs the sequence number with which the server is ready to start with the segments.

Step 3: ACK

ACK (Acknowledgment) is the last step before establishing a successful TCP connection between the client and server. The ACK segment is sent by the client as the response of the received ACK and SN from the server. It results in the establishment of a reliable data connection.

After these three steps, the client and server are ready for the data communication process. TCP connection and termination are full-duplex, which means that the data can travel in both the directions simultaneously.

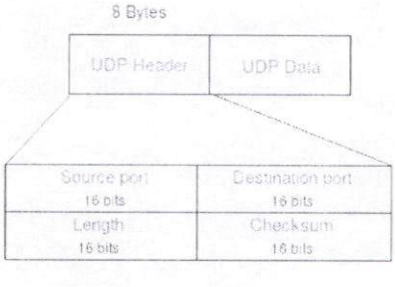
7 b) Recognize the Transport layer services. Explain the UDP protocol with its Header

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 prior to data transfer. The UDP helps to establish low-latency and loss-tolerating connections establish over the network.The UDP enables process to process communication.

Though Transmission Control Protocol (TCP) is the dominant transport layer protocol used with most of the Internet services; provides assured delivery, reliability, and much more but all these services cost us additional overhead and latency. Here, UDP comes into the picture. For real-time services like computer gaming, voice or video communication, live conferences; we need UDP. Since high performance is needed, UDP permits packets to be dropped instead of processing delayed packets. There is no error checking in UDP, so it also saves bandwidth. User Datagram Protocol (UDP) is more efficient in terms of both latency and bandwidth.

UDP Header –

UDP header is an **8-bytes** fixed and simple header, while for TCP it may vary from 20 bytes to 60 bytes. The first 8 Bytes contains all necessary header information and the remaining part consist of data. UDP port number fields are each 16 bits long, therefore the range for port numbers is defined from 0 to 65535; port number 0 is reserved. Port numbers help to distinguish different user requests or processes.



1. **Source Port:** Source Port is a 2 Byte long field used to identify the port number of the source.
2. **Destination Port:** It is a 2 Byte long field, used to identify the port of the destined packet.
3. **Length:** Length is the length of UDP including the header and the data. It is a 16-bits field.
4. **Checksum:** Checksum is 2 Bytes long field. It is the 16-bit one's complement of the one's complement sum of the UDP header, the pseudo-header of information from the IP header, and the data, padded with zero octets at the end (if necessary) to make a multiple of two octets.

8 a) Interpret in detail about E-Mail with its different cases of architecture

E-mail is defined as the transmission of messages on the Internet. It is one of the most commonly used features over communications networks that may contain text, files, images, or other attachments. Generally, it is information that is stored on a computer sent through a network to a specified individual or group of individuals.

Email messages are conveyed through email servers; it uses multiple protocols within the TCP/IP suite. For example, SMTP is a protocol, stands for simple mail transfer protocol and used to send messages whereas other protocols IMAP or POP are used to retrieve messages from a mail server. If you want to login to your mail account, you just need to enter a valid email address, password, and the mail servers used to send and receive messages.

Although most of the webmail servers automatically configure your mail account, therefore, you only required to enter your email address and password. However, you may need to manually configure each account if you use an email client like Microsoft Outlook or Apple Mail. In addition, to enter the email address and password, you may also need to enter incoming and outgoing mail servers and the correct port numbers for each one.

- **Message envelope:** It depicts the email's electronic format.
- **Message header:** It contains email subject line and sender/recipient information.
- **Message body:** It comprises images, text, and other file attachments.

The email was developed to support rich text with custom formatting, and the original email standard is only capable of supporting plain text messages. In modern times, email supports HTML (Hypertext markup language), which makes it capable of emails to support the same formatting as websites. The email that supports HTML can contain links, images, CSS layouts, and also can send files or "email attachments" along with messages. Most of the mail servers enable users to send several attachments with each message. The attachments were typically limited to one megabyte in the early days of email. Still, nowadays, many mail servers are able to support email attachments of 20 megabytes or more in size.

8 b) Appraise in detail about Multimedia streaming audio and video

A. Streaming media is video or audio content sent in compressed form over the internet and played immediately over a user's device, rather than being saved to the device hard drive or solid-state drive. During the streaming process, the media file that's played on the user's device is retrieved from a remote location and transmitted continuously over the internet using a wired or wireless connection.

With streaming media, a user does not have to download an entire audio or video file to play it. Instead, the file is sent in a continuous stream of data to the user's device so it can play as it arrives in real time or near real time. The user can also pause, rewind or fast-forward the file, just as they could with a downloaded file, unless the content is being streamed live, in which case the user can only watch or possibly participate in the event.

Depending on the streaming service, a user may be able to stream and consume different kinds of media, including the following:

- music
- videos
- movies
- TV shows
- podcasts

How streaming works

Streaming files -- audio, video and others -- are stored on a server somewhere on the World Wide Web (WWW). When a user requests the file, it gets transmitted over the web as sequential packets of data that are streamed instantly. Since streaming data is broken down into data packets, its transmission is similar to that of other types of data sent over the internet.

The file is played within a browser on the client's device. An audio or video player hosted by the browser accepts the flow of data packets from the streaming service's remote server and interprets them as video or audio, then plays the media for the user. Unlike traditional media systems where files are downloaded and stored on the device, streaming media files are deleted automatically once the user ends the streaming.

Some streaming services rely on User Datagram Protocol (UDP) to stream their content, while others use Transmission Control Protocol (TCP). Both UDP and TCP are transport protocols used to move data packets across networks. TCP opens a dedicated connection before transmitting data, which makes it a more reliable protocol than UDP. However, TCP also takes longer to transmit data compared to UDP. TCP and UDP are both used with the Internet Protocol (IP).

Most streaming services use content delivery networks (CDNs) to store content in locations that are closer to users. Such proximity reduces streaming latency, speeds up content delivery and reduces buffering.

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FIRST / SECOND SEMESTER EXAMINATION B.Tech./M.Tech./MBA III (CSE-A) Semester I
(Month and year)

Subject : computer Network

Date : 30/10/23

Signature of the Invigilator with date

INSTRUCTIONS TO THE CANDIDATES

1. This booklet contains 16 pages. Candidates must ensure it before writing and in case a defective answer book is issued it must be returned to the invigilator and a new and defect free booklet must be obtained.
2. Before the candidate begins to answer, registered number, particulars of year, semester, subject etc., are to be filled in. Failure to enter all or any of these particulars may disqualify the paper from valuation.
3. Candidate is prohibited from
   (a) Writing.
   - ☞ anything addressing the examiner in any manner whatsoever, in their answer book.
   - ☞ Objectionable/obscene language in the answer book.
   - ☞ anything other than their Registered Number on the question paper.

   (b) either seeking or providing any assistance to the fellow candidates in the exam.
   (c) possessing a manuscript or a printed matter, in any form, in the examination hall.
   (d) bringing loose sheets or paper into the examination hall and detaching any paper from the answer book.
   (e) carrying Mobile Phone to Exam Hall.

   Violation of these instructions will be viewed as a case of malpractice, which is a punishable offence.
4. Before beginning to answer any question, candidates must write the correct question number, in the margin only and should not write anything else in the margin.
5. Answers must be written legibly on both sides of the paper. There shall be about 25 lines in each page. It is not necessary to begin each answer on a fresh page. Candidates should not use any other ink, except BLACK or BLUE ink.
6. Rough work, if any, must be separated, from the subject matter, by a line and noted as rough work.
7. The answer book, at the end of the examination, must be handed over to the Assistant Superintendent (Invigilator) by the candidate **This responsibility lies with the candidate only.**
8. Candidates should maintain absolute silence during the time of examination. Misbehavior, in any form, by the candidate, in the examination hall, will attract severe punishment.
9. Candidates are permitted to leave the examination hall only after the expiry of half of the allotted time and candidates will be permitted to carry the question paper only when they are leaving the exam hall in the last half-an-hour.
10. **No additional answer books will be supplied.**

To be filled in by the Examiner only

PART - A / PART - B

MARKS SLIP

	Q.No.	1	2	3	4	5	—	—	—	—	—	Part-A Total
PART-A	Marks	2	2	2	2	2						10
	Q.No.	6		7		8	—	—	—	—	—	Part-B Total
		A	B	A	B	A	B							
PART-B	Marks	5			5		4							14
Grand Total in Words :											GRAND TOTAL	24

Signature of the Scrutinizer with Date

Signature of the Examiner with Date

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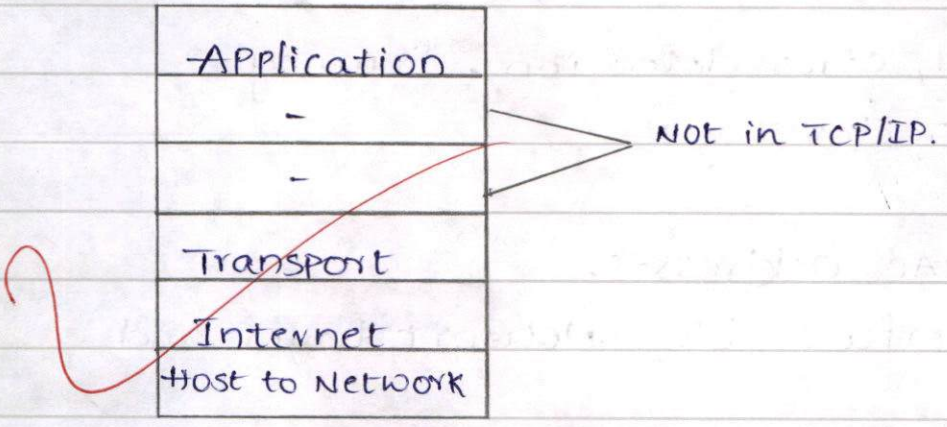
PART - A

① TCP/IP reference model :-



② Guided Transmission Medium	Onguided Transmission Medium
i) In this medium passing in physical path and using Wired system/ bounded communication	i) In this medium it is wireless system / un bounded communication
ii) It is cost efficient.	ii) It is cost Expensive.
iii) It is durable for long dist- -ances.	iii) It is durable for short distances
iv) In this the data passing through Wire. medium.	iv) In this the data passing through air medium.

3) Logical Linked Layer:-

- Responsible for maintain logical line between device and network.
- Manages flow control, error detection, framing between sender and reciever.
- It handles the MAC addresses.
- More reliable interface blw Network layer and physical layer.

---

4) The design issues of framing in data link layer
i) Flow control ii) Error detection iii) Proper addressing
iv) Bit stuffing.

---

5) There are two types of Network Routing algorithm
a) Adaptive Algorithm
b) Non-Adaptive Algorithm

Adaptive divided into three types:-
i) Distribution
ii) centerlised
iii) isolation

Non Adaptive divided into two types:-
i) Flooding
ii) Raod man walk.

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Part-B

6A) comparision b/w OSI seven layer and TCP reference.

OSI seven Layer	TCP/IP.
i) OSI means Open system inter connection.	i) Tcp means Transmission control protocal / Internet protocal.
ii) OSI was developed by ISO (International standard organisation.	ii) TCP/IP was developed by ARPANET
iii) OSI has 7 layers	iii) TCP has 4 layers
iv) OSI is Less reliable	iv) TCP/IP is more reliable.
v) In this model session and presentation layer are different.	v) In this model session and presentation layer in the application layer.
vi) In this model connection less and connection oriented in application layer, but only connection ~~less~~ oriented in the	vi) In this model connection less and connection oriented in application layer, but only connection ~~oriented~~ less

transport layer.	in ~~transport~~ Network layer.
vii) OSI While ensure the data and we can add protocal's easily.	vii) protocal is not possible in TCP/IP.
viii) OSI sketch Application presentation session Transport Network Data physical	viii) TCP/IP sketch Application Transport Internet Host to Network

7B)

The error detect method are

i) Simple parity check.

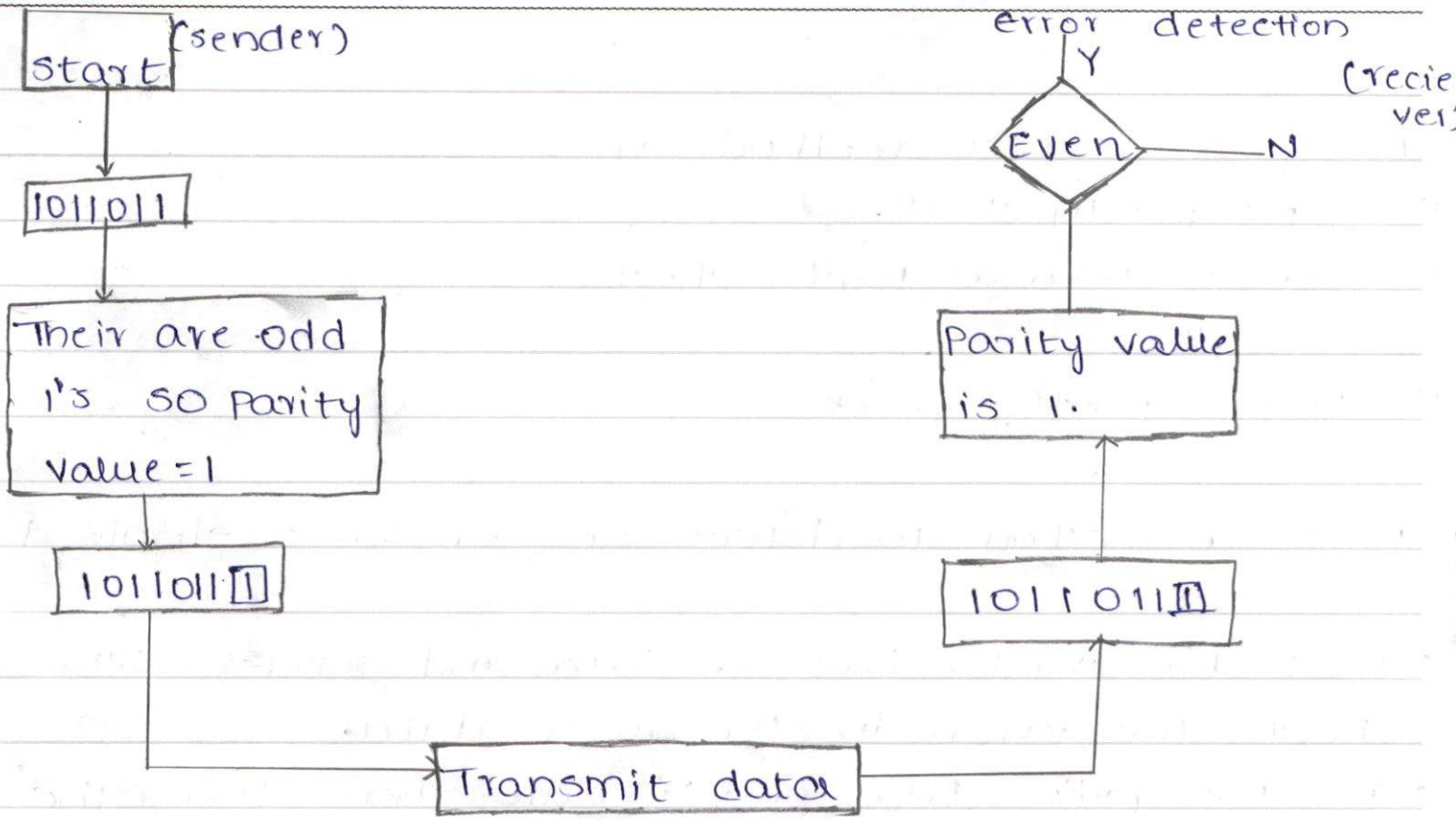
ii) Two dimensional parity checks.

i) Simple parity check.

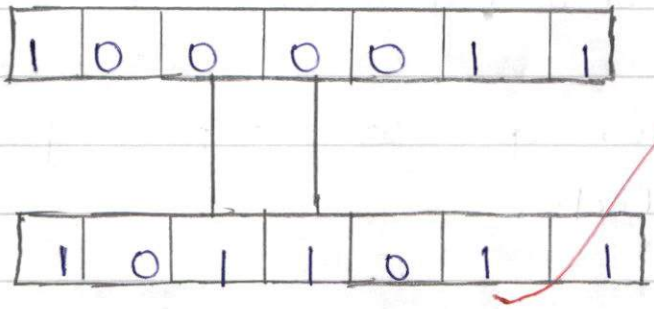
It is a method to detect the errors in single data.

- First the sender have a data and sender will check the errors in the given data.
- In the given data even 1's are there then the parity value is '0' at the end of the data.
- In the given data odd '1's are their the parity value is '1' at the end of the data.
- This same method will check by the reciver after sending data.
- If the sender and reciver get same parity value then error is detected.

Ex:- 1011011



- When their is multiple data the it doesn't detect Errors.



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Two dimensional parity:-

It check the data for multiple data to check errors.

- Write the given data in a row and write the parity values.
- In the given data even '1's are their parity value is '0'.
- In the given data odd '1's are their parity value is '1'.
- check the parity values in both row and coloum and write the parity values.
- The last coloum data we get is error detect value.

Ex: Given data,

data → 10011001, 11010011, 10111100, 11011010

- Write the data in a row

Row ↓ →									Parity
	1	0	0	1	1	0	0	1	0 ↓
	1	1	0	1	0	0	1	1	1
	1	0	1	1	1	1	0	0	1
	1	1	0	1	1	0	1	0	1
Coloum →	0	0	1	0	1	1	0	0	1

The Error detectection. in this data.

10011 00 10, 11010011, 10111100, 11011010, 00101100

8 B)

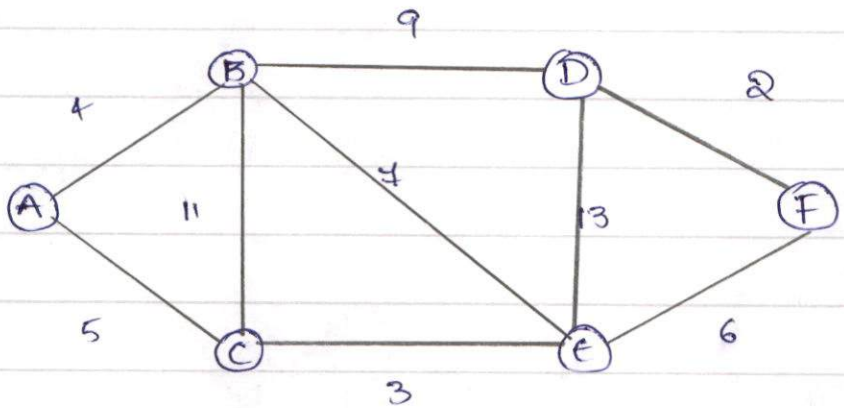
Routing :-

The shortest path to sent the data from sender to reciever is called Raouting.

Routing protocal :-

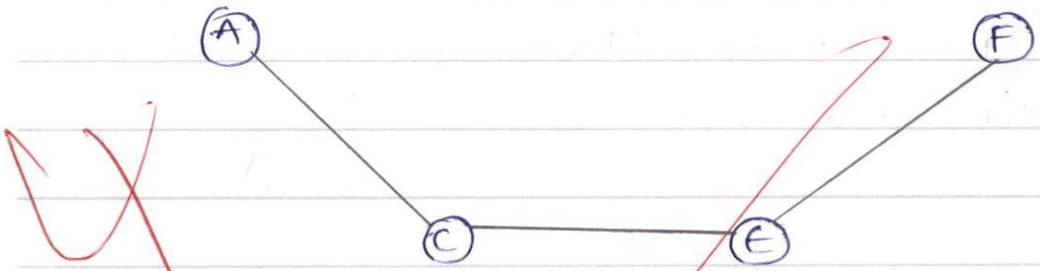
i) **Dijkstra's algorithm :-** This is one of the method to find shortest path in Routing protocal.

Ex :-



A	A	B	C	D	E	F
	0	∞	∞	∞	∞	∞
B		(4)	5	~~∞~~ 9	~~∞~~ 7	∞
C			(5)	9	8	∞
E			(5)	9	8	11
D				9	8	11
F						11

The shortest path is A → C → E → F



This is the shortest path using Dijkstra's Algorithm.

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CSE-A

MID SEMESTER EXAMINATION ANSWER BOOK

Registered No. | 2 | 1 | H | 5 | 1 | A | 0 | 5 | 0 | 8 |

FIRST / SECOND SEMESTER EXAMINATION B.Tech./M.Tech./MBA V-th Semester Dec-2023
(Month and year)

Subject : Computer Networks

Date : 26/12/2023

Signature of the Invigilator with date

INSTRUCTIONS TO THE CANDIDATES

1. This booklet contains 16 pages. Candidates must ensure it before writing and in case a defective answer book is issued it must be returned to the invigilator and a new and defect free booklet must be obtained.
2. Before the candidate begins to answer, registered number, particulars of year, semester, subject etc., are to be filled in. Failure to enter all or any of these particulars may disqualify the paper from valuation.
3. Candidate is prohibited from
   (a) Writing.
   - ☞ anything addressing the examiner in any manner whatsoever, in their answer book.
   - ☞ Objectionable/obscene language in the answer book.
   - ☞ anything other than their Registered Number on the question paper.

   (b) either seeking or providing any assistance to the fellow candidates in the exam.
   (c) possessing a manuscript or a printed matter, in any form, in the examination hall.
   (d) bringing loose sheets or paper into the examination hall and detaching any paper from the answer book.
   (e) carrying Mobile Phone to Exam Hall.

   Violation of these instructions will be viewed as a case of malpractice, which is a punishable offence.
4. Before beginning to answer any question, candidates must write the correct question number, in the margin only and should not write anything else in the margin.
5. Answers must be written legibly on both sides of the paper. There shall be about 25 lines in each page. It is not necessary to begin each answer on a fresh page. Candidates should not use any other ink, except BLACK or BLUE ink.
6. Rough work, if any, must be separated, from the subject matter, by a line and noted as rough work.
7. The answer book, at the end of the examination, must be handed over to the Assistant Superintendent (Invigilator) by the candidate **This responsibility lies with the candidate only.**
8. Candidates should maintain absolute silence during the time of examination. Misbehavior, in any form, by the candidate, in the examination hall, will attract severe punishment.
9. Candidates are permitted to leave the examination hall only after the expiry of half of the allotted time and candidates will be permitted to carry the question paper only when they are leaving the exam hall in the last half-an-hour.
10. **No additional answer books will be supplied.**

To be filled in by the Examiner only

PART - A / PART - B

MARKS SLIP

PART-A	Q.No.	1		2		3	4	5	—	—	—	—	—	**Part-A Total**
	Marks	2		2		2	2	2						10
PART-B	Q.No.	6		7		8	—	—	—	—	—	—	—	**Part-B Total**
		A	B	A	B	A	B							
	Marks	4			4		2							10
Grand Total in Words :												**GRAND TOTAL**		20

Signature of the Scrutinizer with Date

Signature of the Examiner with Date

PART-A

(1A) Congestion Control :- It is the technique and Machanism, when too many packets are entering into the Network. It leads to the increase the delay, if delay increases, performance decrease and hence, the situation become worst.

There are two technique that control Congestion Control.

i) Leaky Bucket algorithm.

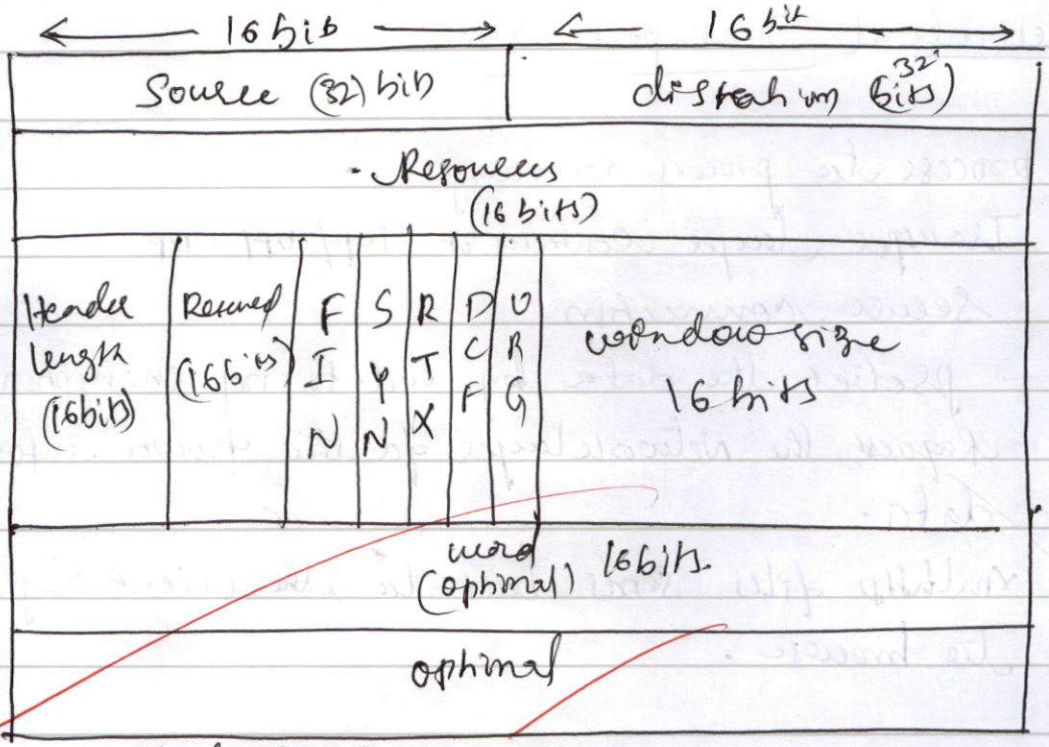
ii) Token bucket algorithm.

i) Leaky Bucket acts as interface when too many packets are enter irrespective of the speed but, it reads in a uniformly.

ii) Token bucket algorithm has a tokens filled in the bucket, each token has a speacate capacity. If there is no buffer capacity, there is no tokens present.

(2A) Skeleton of TCP Header.

TCP (Transmission Control protocol) header is a fixed 24 bits of Tcp socket, which contains the parameters and end-to-end encryption. It can accumate as a virus filters.



TCP Header Sketch

(3A) Socket addressing :- Socket addressing is the combination of IP (Internet protocol) and port number. which is assigned to the particular port number.

ex :- Ip addres : 109.127.0.1

port : 80

Socket addressing = Ip addrs + port numbr

= 109.12.0.1.80.

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(4A) Elements of Transport Layer

→ process to process delivery
→ Transport layer contains of TCP/ ~~UPP~~ UDP
→ Secure connection.
→ protect the data by end-to end encryption method.
→ Request the Network layer for the proper information or data.
→ xml/http files sends back to the client System to browse.

(5A) Domain Name System :- DNS is the most fundamental in the computer network, that can change the naming to the Numerical Ip address. like (109.120.08) So, we can easily locate the network as we can the exact location.

Types of DNS services

i) Domain Name System.
ii) Domain Name Registration.
iii) Domain Authourization
iv) root level.
v) Domain DYS
vi) Domain Recursive Ips

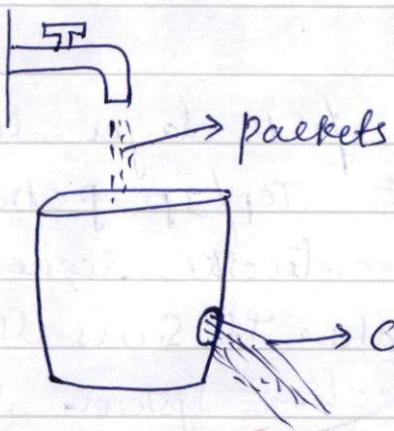
PART-B

(6A) Details about Leaky Bucket and token bucket algorithm.

When there are too many packets approach in the Network layer. the retransmission occurs and the delivery of the packet may cause the trouble. to avoid such retransmission, there algorithms are introduced.

Leaky Bucket Algorithm:-

⇒ Leaky Bucket is the technique and Mechanism, that acts as interface. to avoid the traffic in the network layer.



⇒ the hole to Bucket has a constant flow of the packets.

⇒ Irrespective of the packets entering into the Bucket but leaving the with the constant speed. It can reduce the traffic.

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Token bucket Algorithm:-

⇒ As the leaky bucket is a fixed, and has a loop in the leaky bucket the token bucket Algorithm has a token capacity.

⇒ Each token entering into the bucket if there is space in the bucket, It can enter. Otherwise, it is not able to enter into the bucket.

⇒ If there is no tokens available in the bucket, the the is no overflow in the buffer capacity.

⇒ With this technique, we can control the Congestion.

(7B) Transport layer is the forth layer in the OSI layers and second in the Tcp/Ip protocols. It is the interface to the networks, requesting the network layer for the data. It sends the request to the server from the client system. Server takes the request and sends xml/http files to the Client System to browser.

Services:-

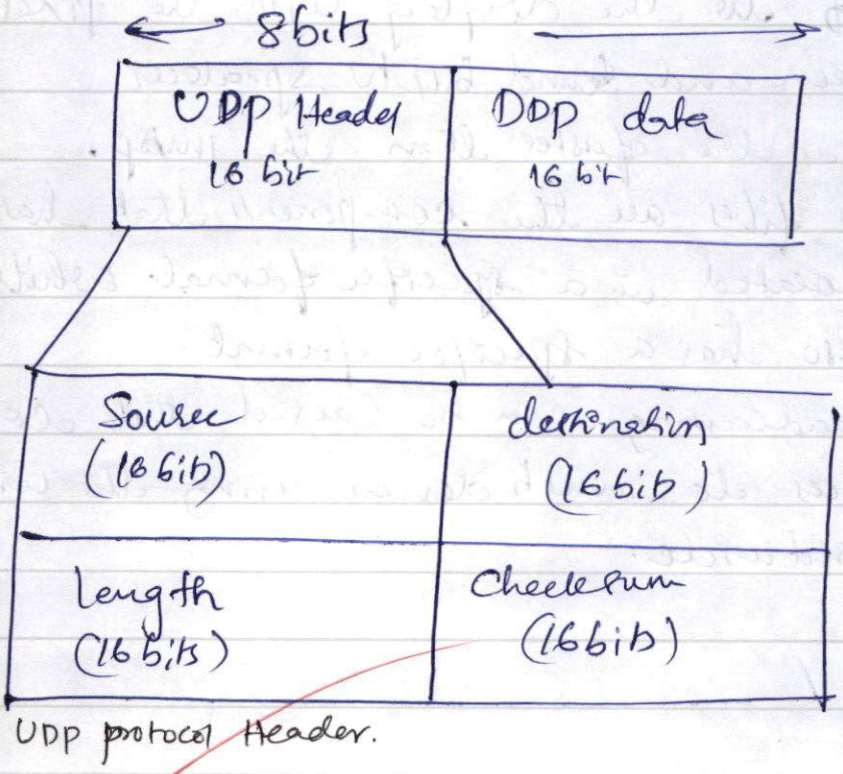
i) process to process delivery.
ii) Sanity of delivering the message.
iii) high security.
iv) End-to-End Encryption.

v) Receiving the acknowledgement from the receiver.
vi) Confirms the message delivered.
vii) Used in the highly sensitive cases.

UDP protocol:

UDP stands for User Datagram protocol, it the 8 bit fixed length protocol.

→ UDP is connection less protocol.
→ fastest delivery of the message.
→ It is mostly used to send message fast delivered reliability to prefer not its secure or security purse
↳ used in videogames ... etc.



UDP protocol Header.

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(8B) Multimedia Streaming audio and video.

Ans:- Multimedia streaming of audio and video is done by the POP3 (post office protocol), that can use for the broad casting, where IMAP (Internet Message access protol) couldn't be used in the Broad Casting.

→ The audio has the bits present in the audio format files and continously sends the bits to the outputs, like speakers.

→ By this request and bits sending into the outputs, and like this the Video files also sends the both to the display with the pixels to the screen and sound bits to speakers.

→ POP3 is the faster than the IMAP.

→ Audio files are the components that has a separate bits located in a specific format while video files are also has a specific format.

→ Broadcasting can be caused that connect a devices to multi devices using the wide range world wide.

UNIT -I

Introduction: Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

Network hardware:

Network hardware is defined as a set of physical or network devices that are essential for interaction and communication between hardware units operational on a computer network.

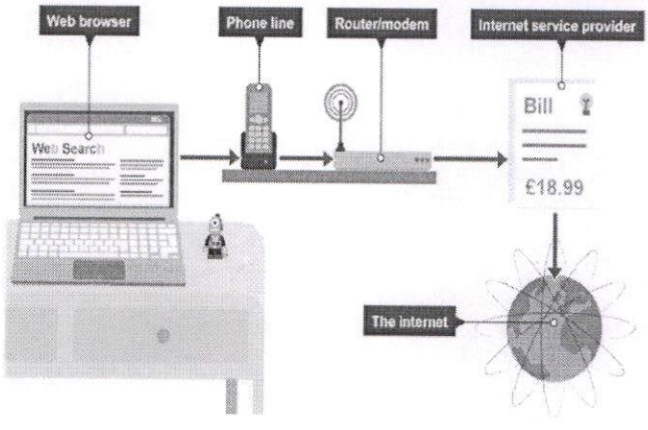
These are dedicated hardware components that connect to each other and enable a network to function effectively and efficiently.

Network hardware is helps in establish an effective mode of communication.

Networks are created when two or more computers are connected. Files are sent over a network as data packets. Networks can be made in different topologies.

Computers need networking hardware in order to connect to each other.

Routers, hubs, switches and bridges are all pieces of networking equipment that can perform slightly different tasks. A router can often incorporate hubs, switches and wireless access within the same hardware.



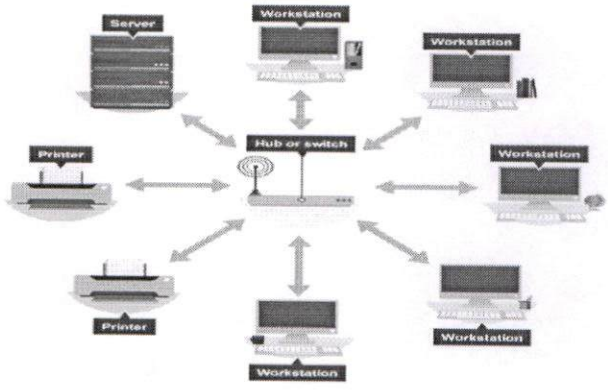
Routers

A router connects two or more networks. One common use of the router is to connect a home or office network (LAN) to the internet (WAN). It generally has a plugged-in internet cable along with cables that connect computers on the LAN. Alternatively, a LAN connection can also be wireless (Wi-Fi-enabled), making the network device wireless. These are also referred to as wireless access points (WAPs).

Modems

A **modem** enables a computer to connect to the internet over a telephone line. A modem converts digital signals from a computer to analogue signals that are then sent down the telephone line. A modem on the other end converts the analogue signal back to a digital signal which another computer can understand.

Hubs, bridges and switches



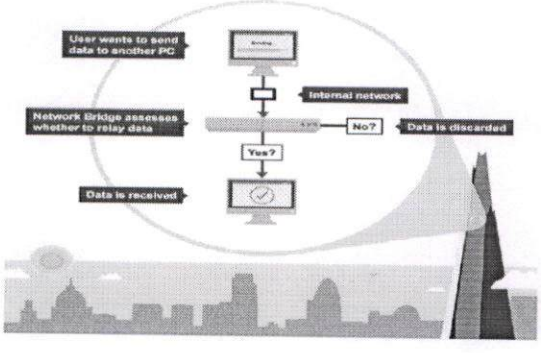
Hubs, **bridges** and **switches** allow multiple devices to connect to the router and they transfer data to all devices on a network. A router is a more complex device that usually includes the capability of hubs, bridges and switches.

Hubs

A hub broadcasts data to all devices on a network. This can use a lot of bandwidth as it results in unnecessary data being sent - not all computers might need to receive the data. A hub would be useful to link up a few games consoles for a local multiplayer game using a wired LAN.

Bridges

A **bridge** is used to connect two separate LAN networks. A computer can act as a bridge through the operating system. A bridge looks for the receiving device before it sends the message. This means that it will not send a message if the receiving computer is not there. It will check to see if the receiver has already had the message. This can help save unnecessary data transfers, which improves the performance of a network.

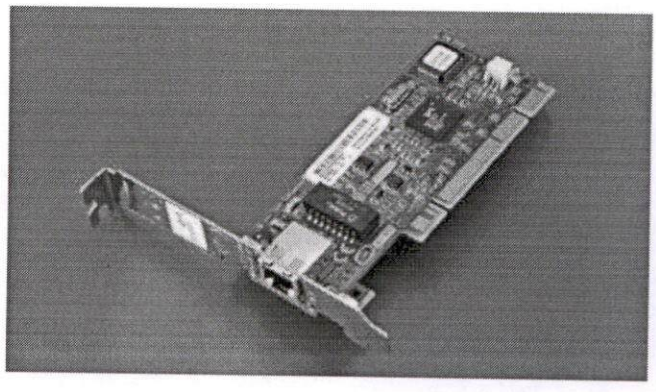


Switches

A **switch** performs a similar role to a hub and a bridge but is more powerful. It stores the MAC addresses of devices on a network and filters data packets to see which devices have asked for them. This makes a switch more efficient when demand is high. If, for example, a game involved lots of data being passed between machines, then a switch could reduce the amount of latency.

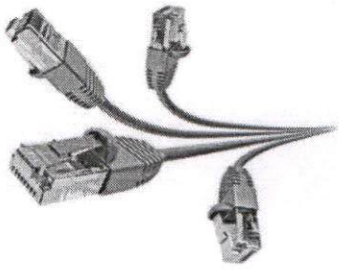
Network interface card (NIC)

NICs enable desktop and laptop computers to connect to a network. NICs are small circuit boards that connect to the motherboard. Smartphones also use a GSM chip to connect to the telephone network. Games consoles contain a NIC card so users can access the internet, download games and play online.



Network cables:

Cables connect different devices on a network. Today, most networks have cables over a wireless connection as they are more secure, i.e., less prone to attacks, and at the same time carry larger volumes of data per second.



Types of network

There are different networking models for how to connect computers over a network. Computers that request information are called clients and computers that provide information are servers. But the client and server relationship can be organised in different ways.

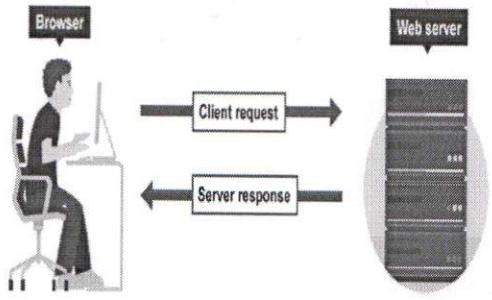
The most widely-used models are client-server or peer-to-peer (P2P).

Client-server

The client-server model is the relationship between two computers in which one, the client, makes a service request from another, the server. The key point about a client-server model is that **the client is dependent on the server to provide and manage the information**.

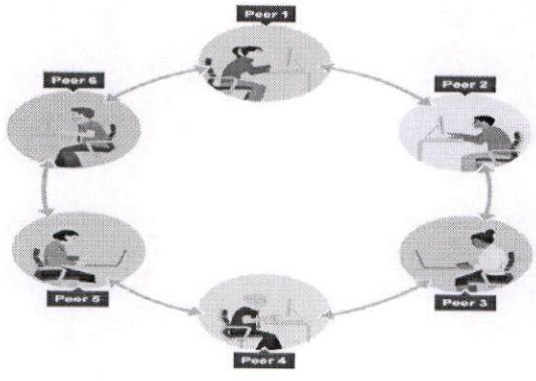
For example, websites are stored on web servers. A web browser is the client which makes a request to the server, and the server sends the website to the browser.

Popular websites need powerful servers to serve thousands or millions of clients, all making requests at the same time. The client side of a web application is often referred to as the front end. The server side is referred to as the back end.



Peer-to-peer (P2P)

In a P2P network, no single provider is responsible for being the server. Each computer stores files and acts as a server. Each computer has equal responsibility for providing data.



In the client-server model, many users trying to access a large file, such as a film, would put strain on one server. In the peer-to-peer model, many users on the network could store the same file. Each computer can then send sections of the file, sharing the workload. Each client can download and share files with other users.

P2P is ideal for sharing files. P2P would be unsuitable for a service such as booking tickets, as one server needs to keep track of how many tickets are left. Also, on P2P networks no single computer is responsible for storing a file - anyone can delete files as they wish.

Differences between client-server and P2P networks

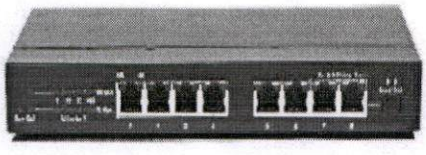
	Client-server	P2P
Security	The server controls security of the network.	No central control over security.
Management	The server manages the network. Needs a dedicated team of people to manage the server.	No central control over the network. Anyone can set up.
Dependency	Clients are dependent on the server.	Clients are not dependent on a central server.
Performance	The server can be upgraded to be made more powerful to cope with high demand.	If machines on the network are slow they will slow down other machines.

	Client-server	P2P
Backups	Data is all backed up on the main server.	Each computer has to be backed up. Data can easily be deleted by users.

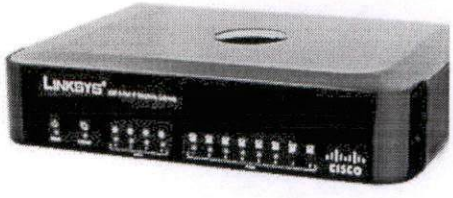
REPEATER

HUB

SWITCH

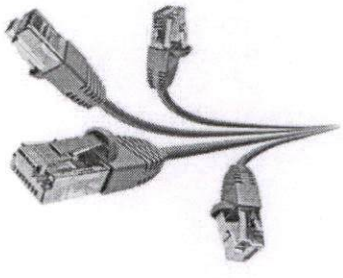


BRIDGE



GATEWAY

ROUTER



CABLES

Reference: **Network Hardware**

https://www.spiceworks.com/tech/networking/articles/what-is-network-hardware/#:~:text=Hardware%20refers%20to%20network%20devices,one%20hardware%20device%20to%20another.

Network software:

Network software is defined as a wide range of software that streamlines the operations, design, monitoring, and implementation of computer networks. Traditional networks were hardware based with software embedded. With the advent of Software - Defined Networking (SDN),

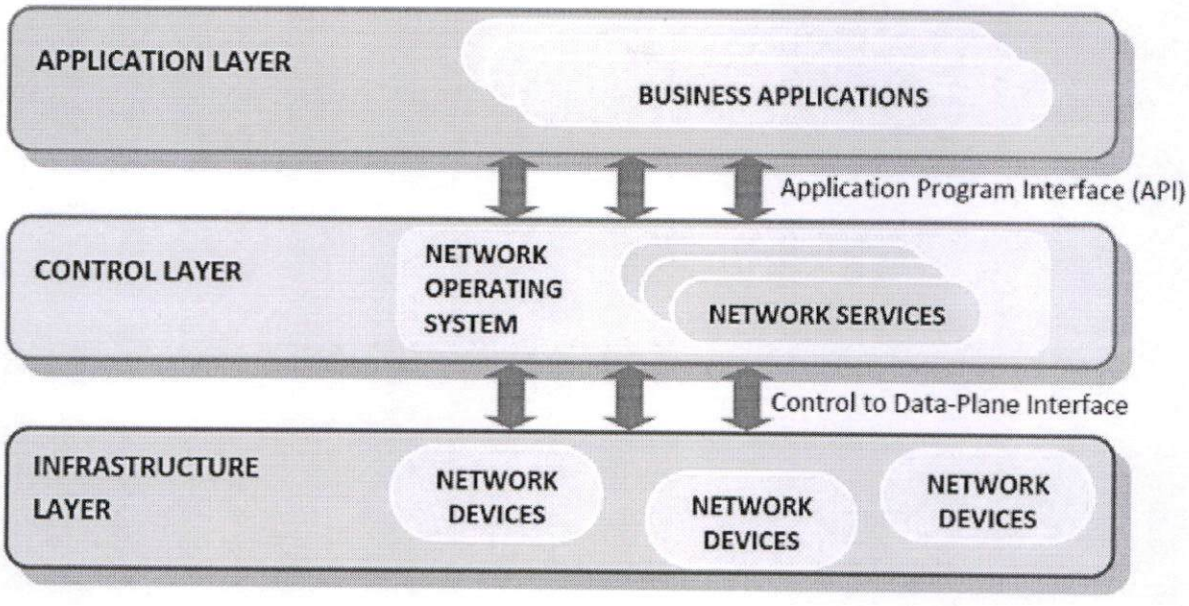
software is separated from the hardware thus making it more adaptable to the ever-changing nature of the computer network.

Functions of Network Software

- Helps to set up and install computer networks
- Enables users to have access to network resources in a seamless manner
- Allows administrations to add or remove users from the network
- Helps to define locations of data storage and allows users to access that data
- Helps administrators and security system to protect the network from data breaches, unauthorized access and attacks on a network
- Enables network virtualizations

Components of Network Software

The Software Defined Networking framework has three layers as depicted in the following diagram



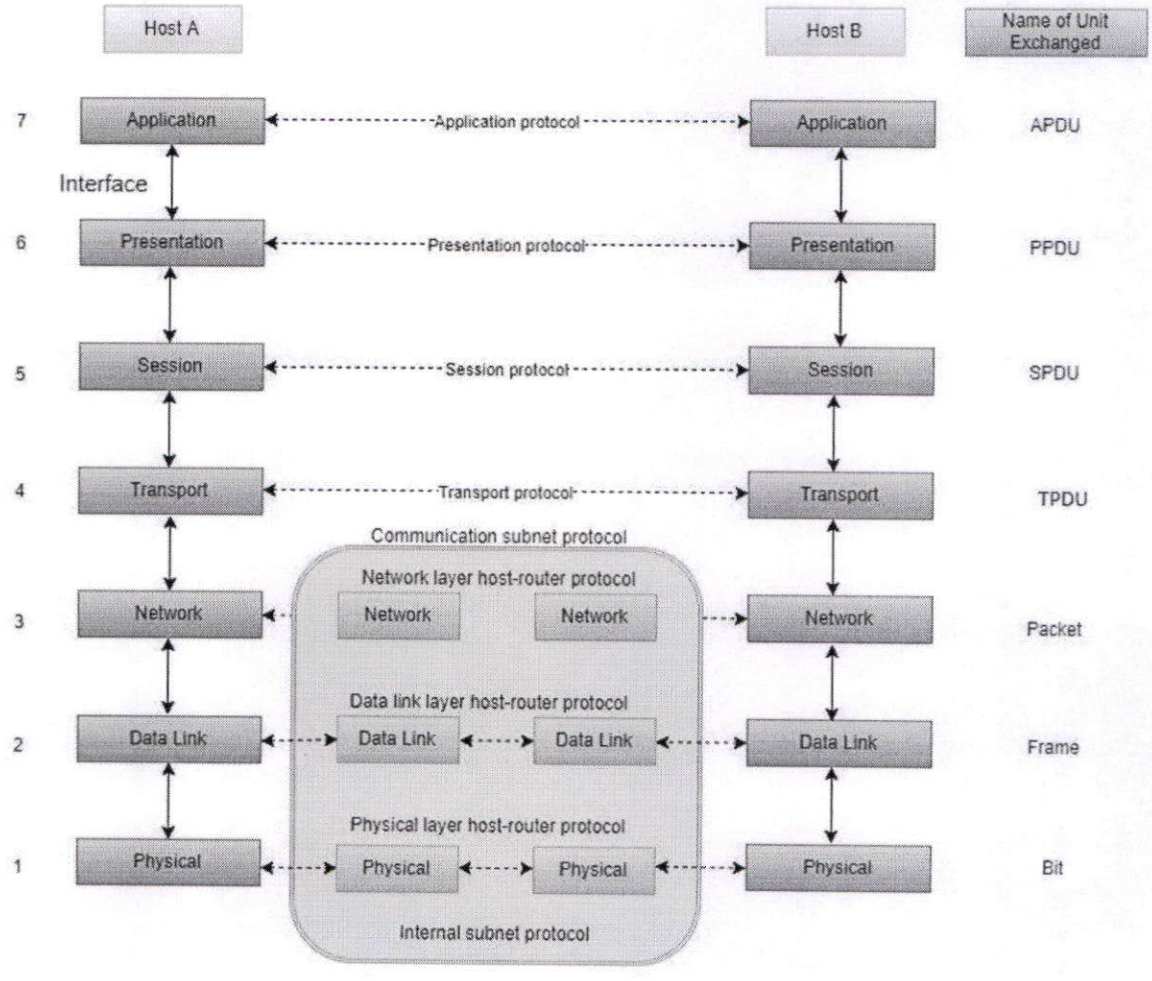
- **APPLICATION LAYER** – SDN applications reside in the Application Layer. The applications convey their needs for resources and services to the control layer through APIs.
- **CONTROL LAYER** – The Network Control Software, bundled into the Network Operating System, lies in this layer. It provides an abstract view of the underlying network infrastructure. It receives the requirements of the SDN applications and relays them to the network components.
- **INFRASTRUCTURE LAYER** – Also called the Data Plane Layer, this layer contains the actual network components. The network devices reside in this layer that shows their network capabilities through the Control to data-Plane Interface.

Reference: Network Software

https://www.spiceworks.com/tech/networking/articles/what-is-network-software/

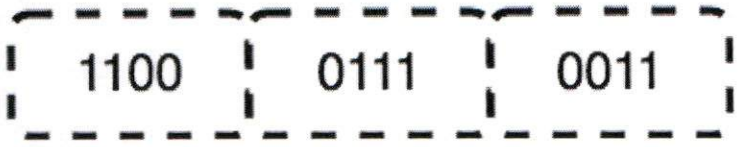
OSI REFERENCE MODEL

OSI stands for **Open Systems Interconnection**. It has been developed by ISO - '**International Organization of Standardization**', in the year 1984. It is 7 layer architecture with each layer having specific functionality to perform. All these 7 layers work collaboratively to transmit the data from one person to another across the globe.



1. Physical Layer (Layer 1) :

The lowest layer of the OSI reference model is the physical layer. It is responsible for the actual physical connection between the devices. The physical layer contains information in the form of **bits.** It is responsible for transmitting individual bits from one node to the next. When receiving data, this layer will get the signal received and convert it into 0s and 1s and send them to the Data Link layer, which will put the frame back together.



The functions of the physical layer are :

1. **Bit synchronization:** The physical layer provides the synchronization of the bits by providing a clock. This clock controls both sender and receiver thus providing synchronization at bit level.
2. **Bit rate control:** The Physical layer also defines the transmission rate i.e. the number of bits sent per second.
3. **Physical topologies:** Physical layer specifies the way in which the different, devices/nodes are arranged in a network i.e. bus, star or mesh topology.
4. **Transmission mode:** Physical layer also defines the way in which the data flows between the two connected devices. The various transmission modes possible are: Simplex, half-duplex and full-duplex.

* **Hub, Repeater, Modem, Cables are Physical Layer devices.**

** **Network Layer, Data Link Layer and Physical Layer are also known as** Lower Layers **or** Hardware Layers**.**

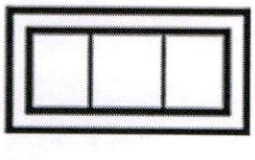
2. Data Link Layer (DLL) (Layer 2) :

The data link layer is responsible for the node to node delivery of the message. The main function of this layer is to make sure data transfer is error-free from one node to another, over the physical layer. When a packet arrives in a network, it is the responsibility of DLL to transmit it to the Host using its MAC address.
Data Link Layer is divided into two sub layers:

1. Logical Link Control (LLC)
2. Media Access Control (MAC)

The packet received from Network layer is further divided into frames depending on the frame size of NIC (Network Interface Card). DLL also encapsulates Sender and Receiver's MAC address in the header.

The Receiver's MAC address is obtained by placing an ARP(Address Resolution Protocol) request onto the wire asking "Who has that IP address?" and the destination host will reply with its MAC address.



The functions of the data Link layer are :

1. **Framing:** Framing is a function of the data link layer. It provides a way for a sender to transmit a set of bits that are meaningful to the receiver. This can be accomplished by attaching special bit patterns to the beginning and end of the frame.
2. **Physical addressing:** After creating frames, Data link layer adds physical addresses (MAC address) of sender and/or receiver in the header of each frame.
3. **Error control:** Data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.
4. **Flow Control:** The data rate must be constant on both sides else the data may get corrupted thus , flow control coordinates that amount of data that can be sent before receiving acknowledgement.
5. **Access control:** When a single communication channel is shared by multiple devices, MAC sub-layer of data link layer helps to determine which device has control over the channel at a given time.

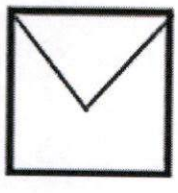
* ***Packet in Data Link layer is referred as*** *Frame.*
** ***Data Link layer is handled by the NIC (Network Interface Card) and device drivers of host machines.***
*** ***Switch & Bridge are Data Link Layer devices.***

3. Network Layer (Layer 3) :

Network layer works for the transmission of data from one host to the other located in different networks. It also takes care of packet routing i.e. selection of the shortest path to transmit the packet, from the number of routes available. The sender & receiver's IP address are placed in the header by the network layer.
The functions of the Network layer are:

1. **Routing:** The network layer protocols determine which route is suitable from source to destination. This function of network layer is known as routing.
2. **Logical Addressing:** In order to identify each device on internetwork uniquely, network layer defines an addressing scheme. The sender & receiver's IP address are placed in the header by network layer. Such an address distinguishes each device uniquely and universally.

* ***Segment*** **in Network layer is referred as** Packet.



** Network layer is implemented by networking devices such as routers.

4. Transport Layer (Layer 4) :

Transport layer provides services to application layer and takes services from network layer. The data in the transport layer is referred to as *Segments*. It is responsible for the End to End Delivery of the complete message. The transport layer also provides the acknowledgement of the successful data transmission and re-transmits the data if an error is found.

• At sender's side:

Transport layer receives the formatted data from the upper layers, performs **Segmentation** and also implements **Flow & Error control** to ensure proper data transmission. It also adds Source and Destination port number in its header and forwards the segmented data to the Network Layer.

Note: The sender need to know the port number associated with the receiver's application. Generally, this destination port number is configured, either by default or manually. For example, when a web application makes a request to a web server, it typically uses port number 80, because this is the default port assigned to web applications. Many applications have default port assigned.

• At receiver's side:

Transport Layer reads the port number from its header and forwards the Data which it has received to the respective application. It also performs sequencing and reassembling of the segmented data.

The functions of the transport layer are :

1. **Segmentation and Reassembly:** This layer accepts the message from the (session) layer , breaks the message into smaller units . Each of the segment produced has a header associated with it. The transport layer at the destination station reassembles the message.
2. **Service Point Addressing:** In order to deliver the message to correct process, transport layer header includes a type of address called service point address or port address. Thus by specifying this address, transport layer makes sure that the message is delivered to the correct process.

The services provided by the transport layer :

1. **Connection Oriented Service:** It is a three-phase process which include
   - Connection Establishment
   - Data Transfer
   - Termination / disconnection

   In this type of transmission, the receiving device sends an acknowledgement, back to the source after a packet or group of packet is received. This type of transmission is reliable and secure.
2. **Connection less service:** It is a one-phase process and includes Data Transfer. In this type of transmission, the receiver does not acknowledge receipt of a packet. This approach allows for much faster communication between devices. Connection-oriented service is more reliable

UNIT-II

Data link layer: Design issues, framing, Error detection and correction.

Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

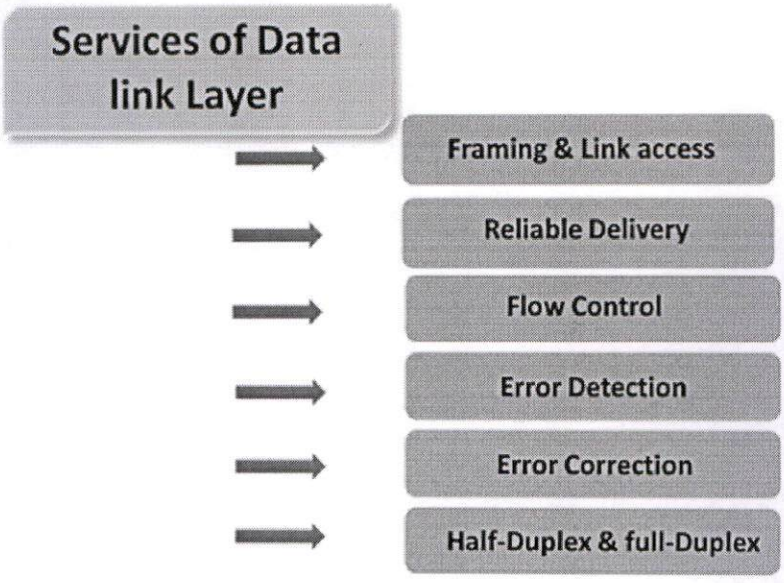
Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.

Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

Data Link Layer

- In the OSI model, the data link layer is a 6^{th} layer from the top and 2^{nd} layer from the bottom.
- The communication channel that connects the adjacent nodes is known as links, and in order to move the datagram from source to the destination, the datagram must be moved across an individual link.
- The main responsibility of the Data Link Layer is to transfer the datagram across an individual link.
- The Data link layer protocol defines the format of the packet exchanged across the nodes as well as the actions such as Error detection, retransmission, flow control, and random access.
- The Data Link Layer protocols are Ethernet, token ring, FDDI and PPP.

- Following services are provided by the Data Link Layer:



Data Link Layer Design Issues

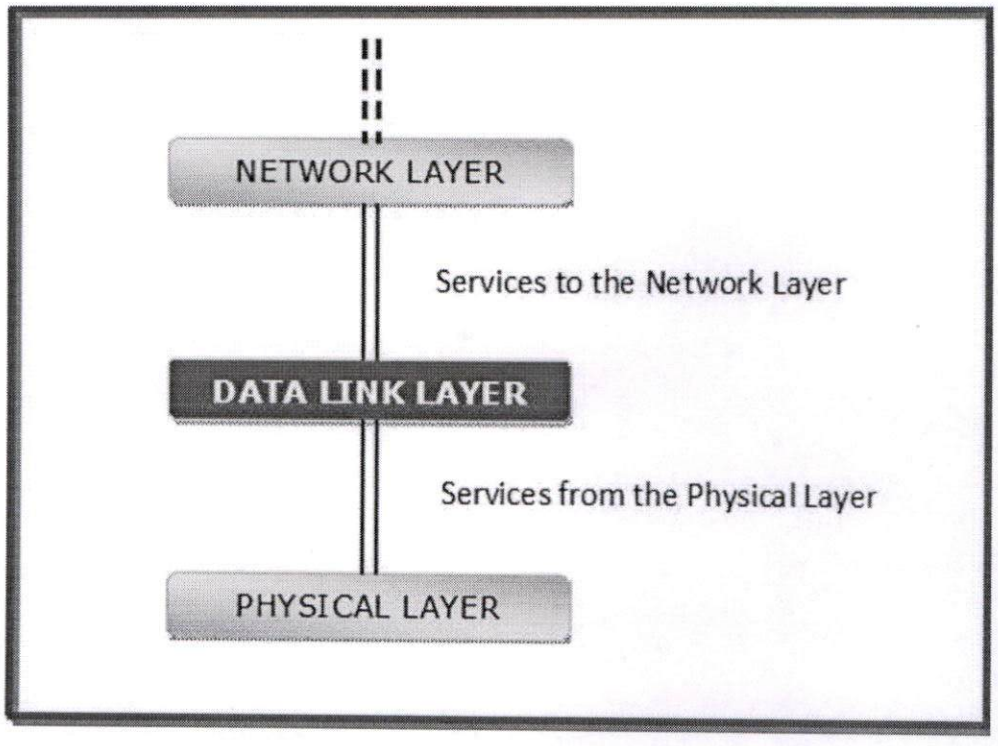
The data link layer in the OSI (Open System Interconnections) Model, is in between the physical layer and the network layer. This layer converts the raw transmission facility provided by the physical layer to a reliable and error-free link.

The main functions and the design issues of this layer are

- Providing services to the network layer
- Framing
- Error Control
- Flow Control

Services to the Network Layer

In the OSI Model, each layer uses the services of the layer below it and provides services to the layer above it. The data link layer uses the services offered by the physical layer.The primary function of this layer is to provide a well defined service interface to network layer above it.

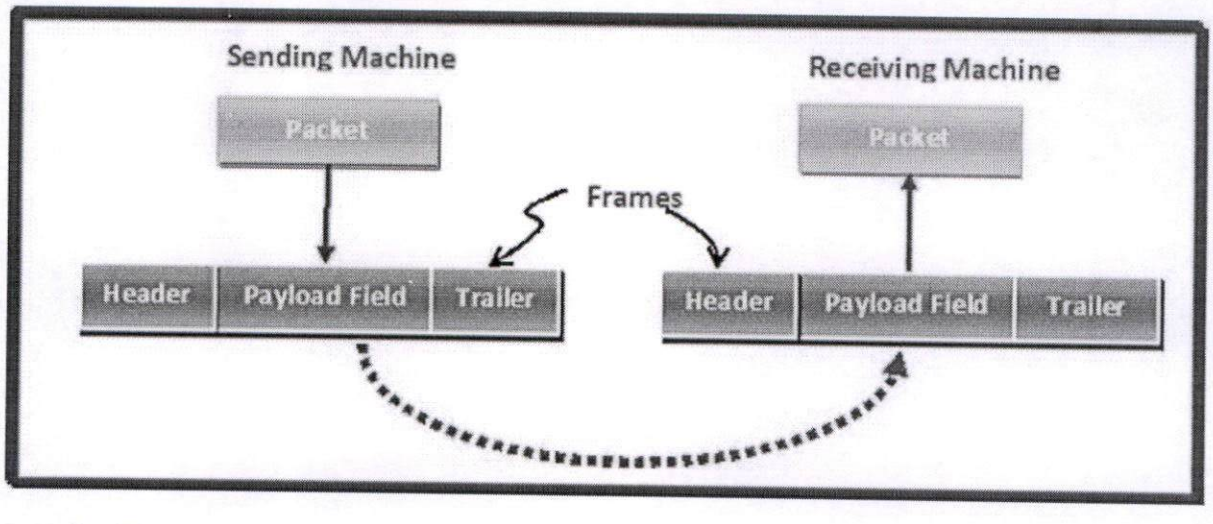


FRAMMING:

In the physical layer, data transmission involves synchronised transmission of bits from the source to the destination. The data link layer converts these bits into frames.

Data-link layer takes the packets from the Network Layer and encapsulates them into frames. If the frame size becomes too large, then the packet may be divided into small sized frames. Smaller sized frames makes flow control and error control more efficient.

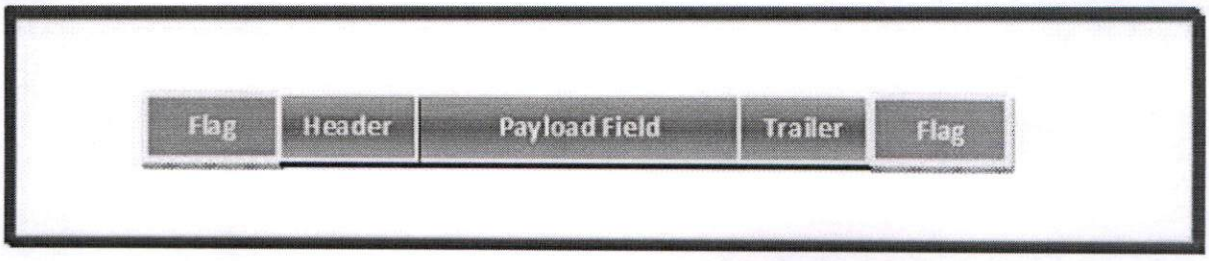
Then, it sends each frame bit-by-bit on the hardware. At receiver's end, data link layer picks up signals from hardware and assembles them into frames.



Parts of a Frame

A frame has the following parts –

- Frame Header – It contains the source and the destination addresses of the frame.
- Payload field – It contains the message to be delivered.
- Trailer – It contains the error detection and error correction bits.
- Flag – It marks the beginning and end of the frame.



Types of framing

There are two types of framing:

1. Fixed size – The frame is of fixed size and there is no need to provide boundaries to the frame, length of the frame itself acts as delimiter.

- ✓ **Drawback:** It suffers from internal fragmentation if data size is less than frame size
- ✓ **Solution:** Padding

2. Variable size – In this there is need to define end of frame as well as beginning of next frame to distinguish. This can be done in two ways:

1. Length field – We can introduce a length field in the frame to indicate the length of the frame. Used in **Ethernet (802.3)**.

The problem with this is that sometimes the length field might get corrupted.

2. End Delimeter (ED) – We can introduce an ED(pattern) to indicate the end of the frame.

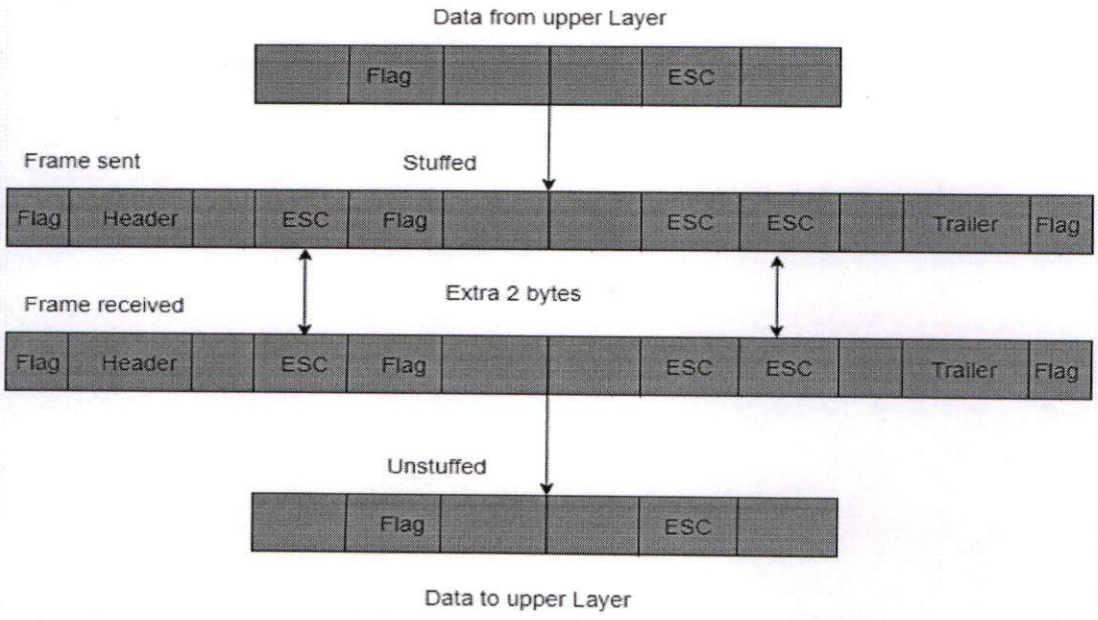
Used in **Token Ring**. The problem with this is that ED can occur in the data. This can be solved by:

1. Character/Byte Stuffing:

In this method a flag byte, is used as both the starting and ending of a frame. See in the figure below.

Two consecutive flag bytes indicate the end of one frame and the start of the next frame.

If the receiver ever loses synchronization it can just search for two flag bytes to find the end of the current frame and the start of the next frame.



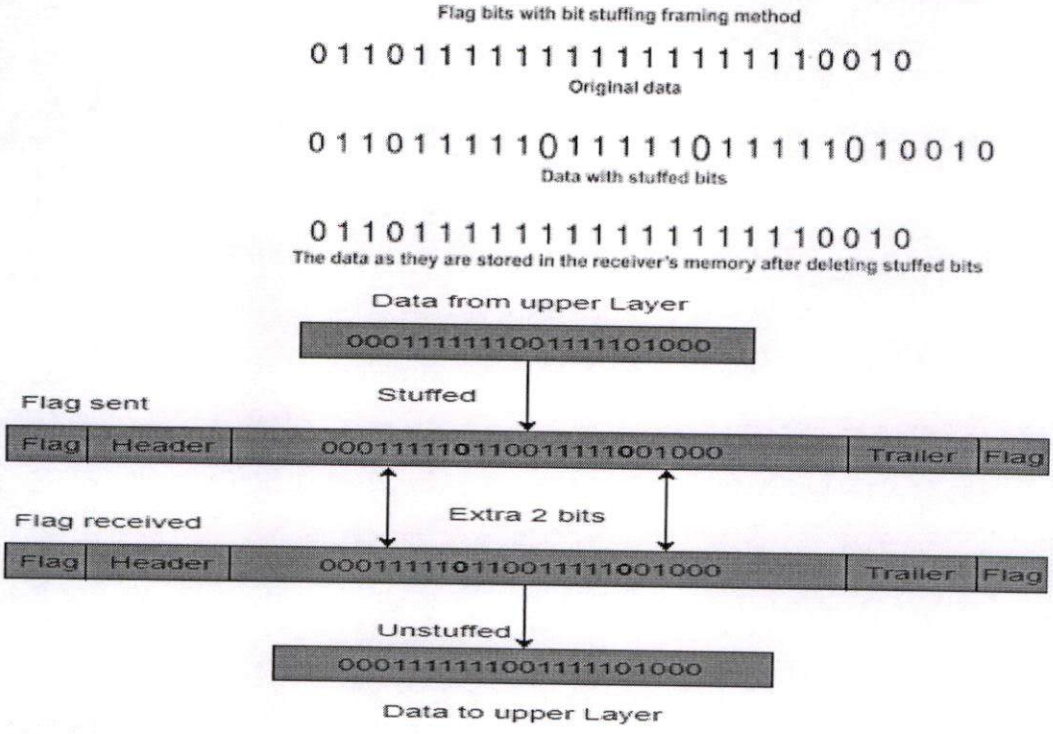
Disadvantage – It is very costly and obsolete method.

2. Bit stuffing framing method:

In this method bit stuffing is used.

When sender's data link layer encounters five consecutive 1s in the data, it automatically stuffs a 0 bit.

At receiver end this stuffed 0 bit automatically deleted. As shown in the figure below.



3. CHARACTER count framing method:

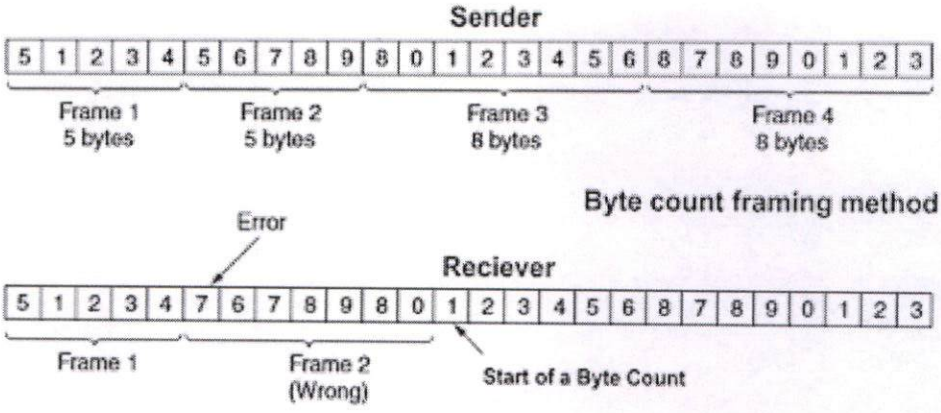
The byte count framing method uses a field in the header to specify the number of bytes in the frame.

Data link layer at sender sends the byte count.

Data link layer at receiver counts the byte count. send by sender.

If there is difference between bytes counts of sender and receiver. There is error in data received. Else received data is correct.

Above points are shown in diagram below.



Error Detection

Data-link layer uses error control techniques to ensure that frames, i.e. bit streams of data, are transmitted from the source to the destination with a certain extent of accuracy.

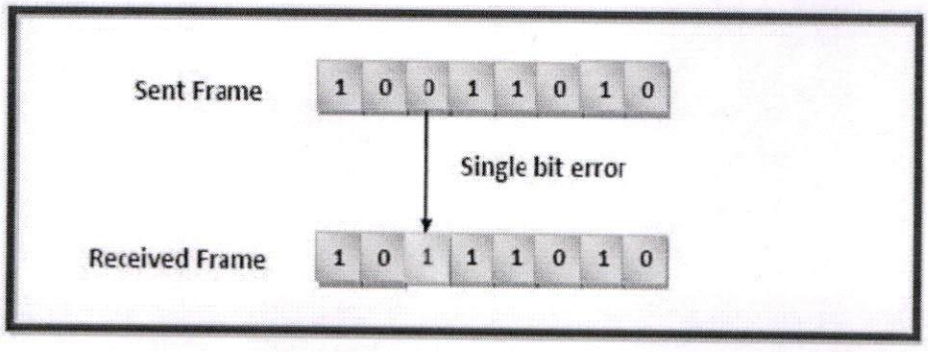
Errors

When bits are transmitted over the computer network, they are subject to get corrupted due to interference and network problems. The corrupted bits leads to false or fake data being received by the destination and are called errors.

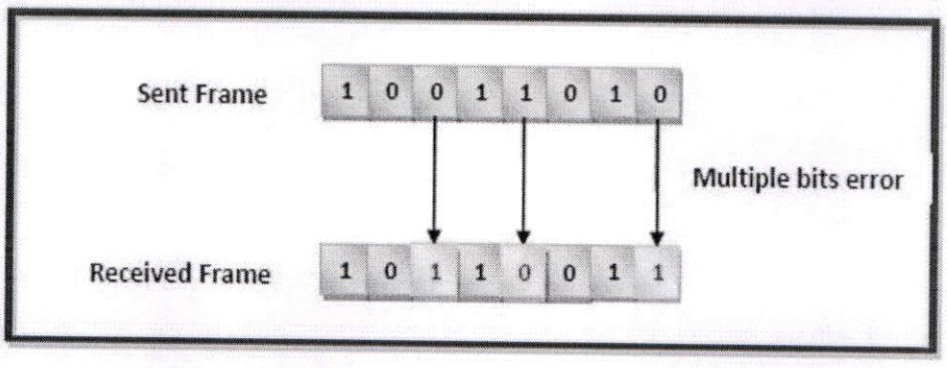
Types of Errors

Errors can be of three types, namely single bit errors, multiple bit errors, and burst errors.

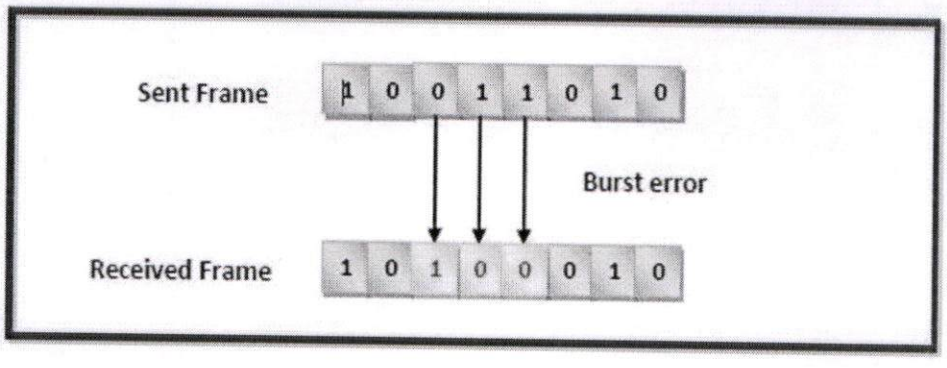
- **Single bit error** – In the received frame, only one bit has been corrupted, i.e. either changed from 0 to 1 or from 1 to 0.



- **Multiple bits error** – In the received frame, more than one bits are corrupted.



- **Burst error** – In the received frame, more than one consecutive bits are corrupted.



https://www.tutorialspoint.com/error-detection-and-correction-in-data-link-layer

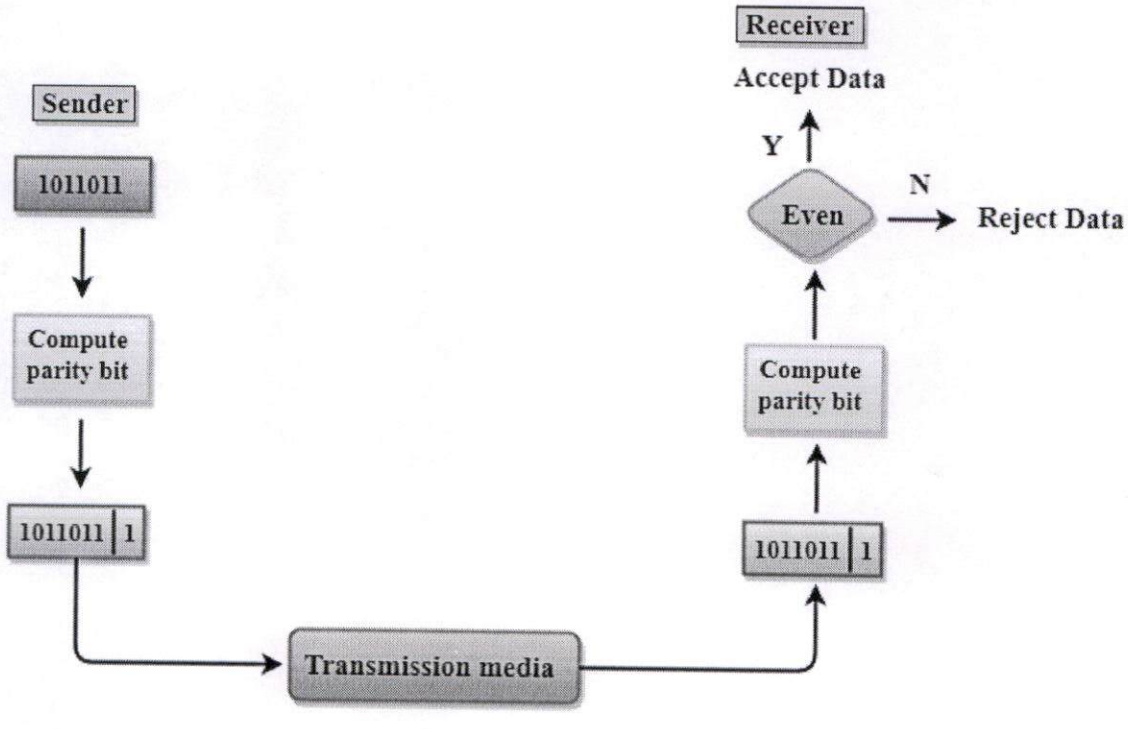
Error Detecting Techniques:

The most popular Error Detecting Techniques are:

- Single parity check
- Two-dimensional parity check
- Checksum
- Cyclic redundancy check

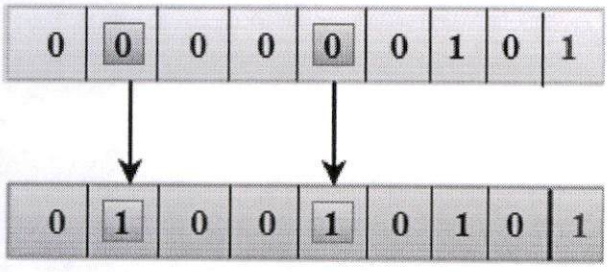
1. Single Parity Check

- Single Parity checking is the simple mechanism and inexpensive to detect the errors.
- In this technique, a redundant bit is also known as a parity bit which is appended at the end of the data unit so that the number of 1s becomes even. Therefore, the total number of transmitted bits would be 9 bits.
- If the number of 1s bits is odd, then parity bit 1 is appended and if the number of 1s bits is even, then parity bit 0 is appended at the end of the data unit.
- At the receiving end, the parity bit is calculated from the received data bits and compared with the received parity bit.
- This technique generates the total number of 1s even, so it is known as even-parity checking.



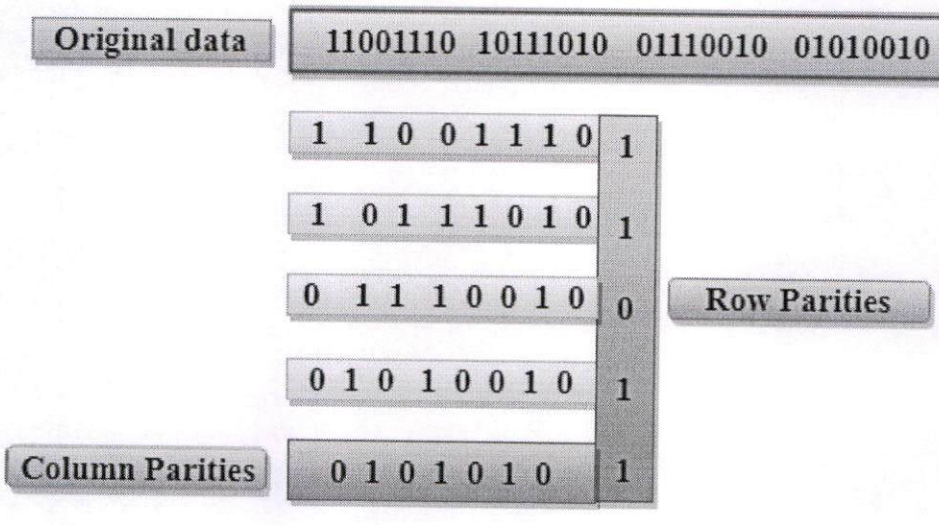
Drawbacks Of Single Parity Checking

- It can only detect single-bit errors which are very rare.
- If two bits are interchanged, then it cannot detect the errors.



2. Two-Dimensional Parity Check

- Performance can be improved by using **Two-Dimensional Parity Check** which organizes the data in the form of a table.
- Parity check bits are computed for each row, which is equivalent to the single-parity check.
- In Two-Dimensional Parity check, a block of bits is divided into rows, and the redundant row of bits is added to the whole block.
- At the receiving end, the parity bits are compared with the parity bits computed from the received data.



Drawbacks Of 2D Parity Check

- If two bits in one data unit are corrupted and two bits exactly the same position in another data unit are also corrupted, then 2D Parity checker will not be able to detect the error.
- This technique cannot be used, to detect the 4-bit errors or more in some cases.

3. Checksum

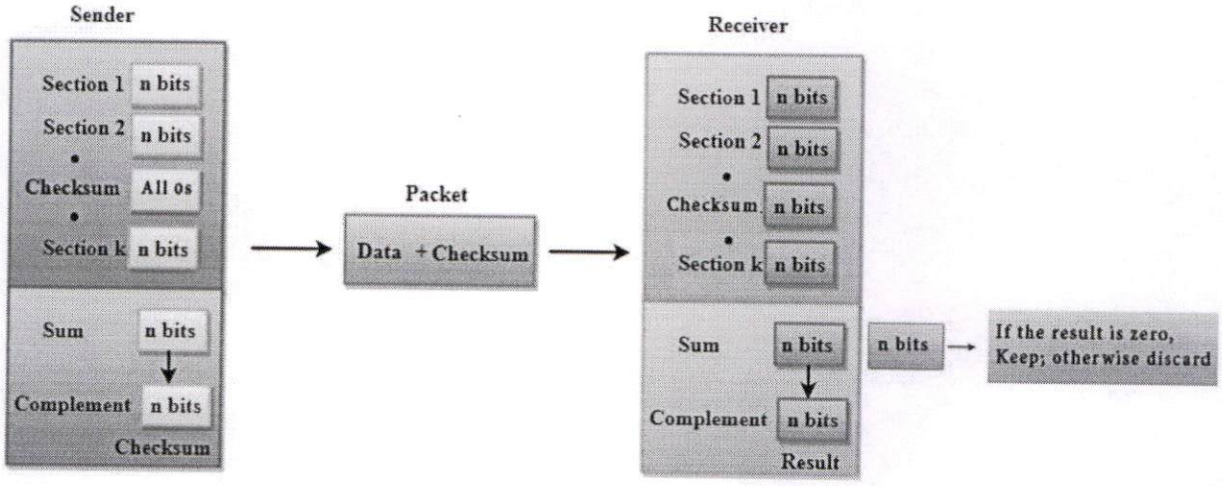
A Checksum is an error detection technique based on the concept of redundancy (no longer needed or useful).

It is divided into two parts:

Checksum Generator

A Checksum is generated at the sending side. Checksum generator subdivides the data into equal segments of n bits each, and all these segments are added together by using one's complement arithmetic. The sum is complemented and appended to the original data, known as checksum field. The extended data is transmitted across the network.

Suppose L is the total sum of the data segments, then the checksum would be ?L



1. The Sender follows the given steps:
2. The block unit is divided into k sections, and each of n bits.
3. All the k sections are added together by using one's complement to get the sum.
4. The sum is complemented and it becomes the checksum field.
5. The original data and checksum field are sent across the network.

Checksum Checker

A Checksum is verified at the receiving side. The receiver subdivides the incoming data into equal segments of n bits each, and all these segments are added together, and then this sum is complemented. If the complement of the sum is zero, then the data is accepted otherwise data is rejected.

4. Cyclic Redundancy Check (CRC)

CRC is a redundancy error technique used to determine the error.

Following are the steps used in CRC for error detection:

- In CRC technique, a string of n 0s is appended to the data unit, and this n number is less than the number of bits in a predetermined number, known as division which is n+1 bits.
- Secondly, the newly extended data is divided by a divisor using a process is known as binary division. The remainder generated from this division is known as CRC remainder.

UNIT-III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

Network layer

- The Network Layer is the third layer of the OSI model.
- The main role of the network layer is to move the packets from sending host to the receiving host.
- It handles the service requests from the transport layer and further forwards the service request to the data link layer.
- The network layer translates the logical addresses into physical addresses
- It determines the route from the source to the destination and also manages the traffic problems such as routing and controls the congestion of data packets.

Before learning about design issues in the network layer, let's learn about it's various functions.

- ✓ **Addressing:**
  Maintains the address at the frame header of both source and destination and performs addressing to detect various devices in network.
- ✓ **Packeting:**
  This is performed by Internet Protocol. The network layer converts the packets from its upper layer.
- ✓ **Routing:**
  It is the most important functionality. The network layer chooses the most relevant and best path for the data transmission from source to destination.
- ✓ **Inter-networking:**
  It works to deliver a logical connection across multiple devices.

REFERENCE:

https://www.javatpoint.com/network-layer

Network layer design issues:

The network layer comes with some design issues they are described as follows:

1. Store and Forward packet switching:
The host sends the packet to the nearest router. This packet is stored there until it has fully arrived once the link is fully processed by verifying the checksum then it is forwarded to the next router till it reaches the destination. This mechanism is called "Store and Forward packet switching."

2. Services provided to Transport Layer:
Through the network/transport layer interface, the network layer transfers it's services to the transport layer. These services are described below.
But before providing these services to the transfer layer following goals must be kept in mind :-

- ✓ Offering services must not depend on router technology.
- ✓ The transport layer needs to be protected from the type, number and topology of the available router.
- ✓ The network addresses for the transport layer should use uniform numbering pattern also at LAN and WAN connections.

Based on the connections there are 2 types of services provided :

- ✓ **Connectionless** – The routing and insertion of packets into subnet is done individually. No added setup is required.
- ✓ **Connection-Oriented** – Subnet must offer reliable service and all the packets must be transmitted over a single route.

3. Implementation of Connectionless Service**:**

Packet are termed as "datagrams" and corresponding subnet as "datagram subnets". When the message size that has to be transmitted is 4 times the size of the packet, then the network layer divides into 4 packets and transmits each packet to router via. a few protocol.Each data packet has destination address and is routed independently irrespective of the packets.

4. Implementation of Connection Oriented service:

To use a connection-oriented service, first we establishes a connection, use it and then release it. In connection-oriented services, the data packets are delivered to the receiver in the same order in which they have been sent by the sender.

It can be done in either two ways :

- ✓ **Circuit Switched Connection** – A dedicated physical path or a circuit is established between the communicating nodes and then data stream is transferred.
- ✓ **Virtual Circuit Switched Connection** – The data stream is transferred over a packet switched network, in such a way that it seems to the user that there is a dedicated path from the sender to the receiver. A virtual path is established here. While, other connections may also be using the same path.

Shortest Path Routing

In **computer networks**, the shortest path algorithms aim to find the optimal paths between the network nodes so that routing cost is minimized. They are direct applications of the shortest path algorithms proposed in graph theory.

Explanation

Consider that a network comprises of N vertices (nodes or network devices) that are connected by M edges (transmission lines). Each edge is associated with a weight, representing the physical distance or the transmission delay of the transmission line. The target of shortest path algorithms is to find a route between any pair of vertices along the edges, so the sum of weights of edges is minimum. If the edges are of equal weights, the shortest path algorithm aims to find a route having minimum number of hops.

Common Shortest Path Algorithms

Some common shortest path algorithms are –

- Dijkstra's Algorithm
- Bellman Ford's Algorithm
- Floyd Warshall's Algorithm

https://www.tutorialspoint.com/shortest-path-algorithm-in-computer-network

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1. Dijkstra's

Dijkstra's Algorithm. Dijkstra's Algorithm is a Graph algorithm **that finds the shortest path** from a source vertex to all other vertices in the Graph (single source shortest path). It is a type of Greedy Algorithm that only works on Weighted Graphs having positive weights. The time complexity of Dijkstra's Algorithm is $\mathbf{O(V^2)}$ with the help of the adjacency matrix representation of the graph. This time complexity can be reduced to $\mathbf{O((V + E) \log V)}$ with the help of an adjacency list representation of the graph, where **V** is the number of vertices and **E** is the number of edges in the graph.

Fundamentals of Dijkstra's Algorithm

The following are the basic concepts of Dijkstra's Algorithm:

1. Dijkstra's Algorithm begins at the node we select (the source node), and it examines the graph to find the shortest path between that node and all the other nodes in the graph.
2. The Algorithm keeps records of the presently acknowledged shortest distance from each node to the source node, and it updates these values if it finds any shorter path.
3. Once the Algorithm has retrieved the shortest path between the source and another node, that node is marked as 'visited' and included in the path.
4. The procedure continues until all the nodes in the graph have been included in the path. In this manner, we have a path connecting the source node to all other nodes, following the shortest possible path to reach each node.

Understanding the Working of Dijkstra's Algorithm

A **graph** and **source vertex** are requirements for Dijkstra's Algorithm. This Algorithm is established on Greedy Approach and thus finds the locally optimal choice (local minima in this case) at each step of the Algorithm.

Each Vertex in this Algorithm will have two properties defined for it:

1. Visited Property
2. Path Property

Let us understand these properties in brief.

Visited Property:

1. The 'visited' property signifies whether or not the node has been visited.
2. We are using this property so that we do not revisit any node.
3. A node is marked visited only when the shortest path has been found.

Path Property:

1. The 'path' property stores the value of the current minimum path to the node.
2. The current minimum path implies the shortest way we have reached this node till now.
3. This property is revised when any neighbor of the node is visited.
4. This property is significant because it will store the final answer for each node.

Initially, we mark all the vertices, or nodes, unvisited as they have yet to be visited. The path to all the nodes is also set to infinity apart from the source node. Moreover, the path to the source node is set to zero (0).

We then select the source node and mark it as visited. After that, we access all the neighboring nodes of the source node and perform relaxation on every node. Relaxation is the process of lowering the cost of reaching a node with the help of another node.

In the process of relaxation, the path of each node is revised to the minimum value amongst the node's current path, the sum of the path to the previous node, and the path from the previous node to the current node.

Let us suppose that p[n] is the value of the current path for node n, p[m] is the value of the path up to the previously visited node m, and w is the weight of the edge between the current node and previously visited one (edge weight between n and m).

In the mathematical sense, relaxation can be exemplified as:

p[n] = minimum(p[n], p[m] + w)

We then mark an unvisited node with the least path as visited in every subsequent step and update its neighbor's paths.

We repeat this procedure until all the nodes in the graph are marked visited.

Whenever we add a node to the visited set, the path to all its neighboring nodes also changes accordingly.

If any node is left unreachable (disconnected component), its path remains 'infinity'. In case the source itself is a separate component, then the path to all other nodes remains 'infinity'.

Understanding Dijkstra's Algorithm with an Example

The following is the step that we will follow to implement Dijkstra's Algorithm:

Step 1: First, we will mark the source node with a current distance of 0 and set the rest of the nodes to INFINITY.

Step 2: We will then set the unvisited node with the smallest current distance as the current node, suppose X.

Step 3: For each neighbor N of the current node X: We will then add the current distance of X with the weight of the edge joining X-N. If it is smaller than the current distance of N, set it as the new current distance of N.

Step 4: We will then mark the current node X as visited.

Step 5: We will repeat the process from **'Step 2'** if there is any node unvisited left in the graph.

Let us now understand the implementation of the algorithm with the help of an example:

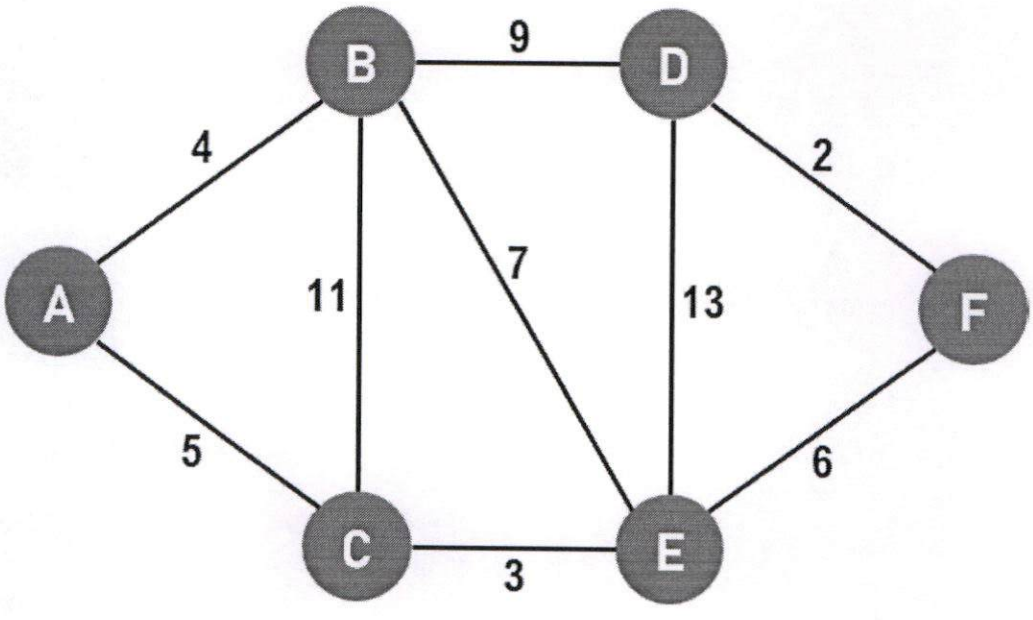


Figure 6: The Given Graph

1. We will use the above graph as the input, with node **A** as the source.
2. First, we will mark all the nodes as unvisited.
3. We will set the path to **0** at node **A** and **INFINITY** for all the other nodes.
4. We will now mark source node **A** as visited and access its neighboring nodes.
   Note: We have only accessed the neighboring nodes, not visited them.
5. We will now update the path to node **B** by **4** with the help of relaxation because the path to node **A** is **0** and the path from node **A** to **B** is **4**, and the **minimum((0 + 4), INFINITY)** is **4**.
6. We will also update the path to node **C** by **5** with the help of relaxation because the path to node **A** is **0** and the path from node **A** to **C** is **5**, and the **minimum((0 + 5), INFINITY)** is **5**. Both the neighbors of node **A** are now relaxed; therefore, we can move ahead.
7. We will now select the next unvisited node with the least path and visit it. Hence, we will visit node **B** and perform relaxation on its unvisited neighbors. After performing relaxation, the path to node **C** will remain **5**, whereas the path to node **E** will become **11**, and the path to node **D** will become **13**.
8. We will now visit node **E** and perform relaxation on its neighboring nodes **B, D**, and **F**. Since only node **F** is unvisited, it will be relaxed. Thus, the path to node **B** will remain as it is, i.e., **4**, the path to node **D** will also remain **13**, and the path to node **F** will become **14 (8 + 6)**.
9. Now we will visit node **D**, and only node **F** will be relaxed. However, the path to node **F** will remain unchanged, i.e., **14**.

10. Since only node **F** is remaining, we will visit it but not perform any relaxation as all its neighboring nodes are already visited.
11. Once all the nodes of the graphs are visited, the program will end.

Hence, the final paths we concluded are:

1. A = 0
2. B = 4 (A -> B)
3. C = 5 (A -> C)
4. D = 4 + 9 = 13 (A -> B -> D)
5. E = 5 + 3 = 8 (A -> C -> E)
6. F = 5 + 3 + 6 = 14 (A -> C -> E -> F)

https://www.javatpoint.com/dijkstras-algorithm

YouTube Link

https://www.youtube.com/watch?v=smHnz2RHJBY

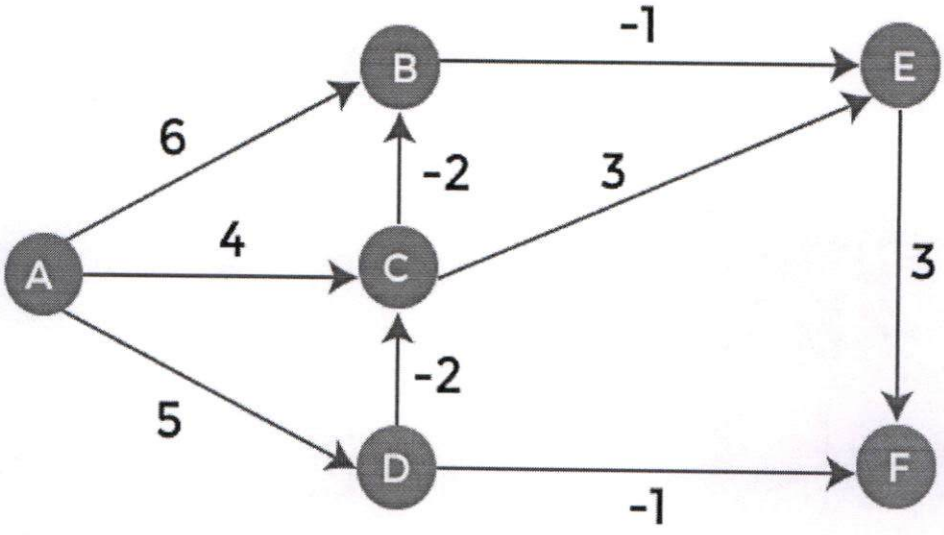
2. Bellman Ford Algorithm

Bellman ford algorithm is a single-source shortest path algorithm. This algorithm is used to find the shortest distance from the single vertex to all the other vertices of a weighted graph. There are various other algorithms used to find the shortest path like Dijkstra algorithm, etc. If the weighted graph contains the negative weight values, then the Dijkstra algorithm does not confirm whether it produces the correct answer or not. In contrast to Dijkstra algorithm, bellman ford algorithm guarantees the correct answer even if the weighted graph contains the negative weight values.

Rule of this algorithm

1. We will go on relaxing all the edges (n - 1) times where,
2. n = number of vertices

Consider the below graph:



As we can observe in the above graph that some of the weights are negative. The above graph contains 6 vertices so we will go on relaxing till the 5 vertices. Here, we will relax all the edges 5 times. The loop will iterate 5 times to get the correct answer. If the loop is iterated more than 5 times then also the answer will be the same, i.e., there would be no change in the distance between the vertices.

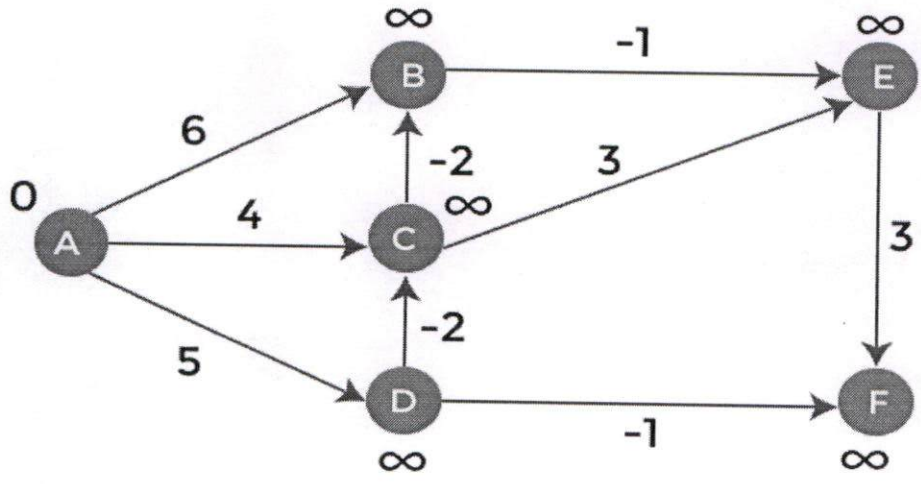
Relaxing means:

1. If (d(u) + c(u , v) < d(v))
2. d(v) = d(u) + c(u , v)

To find the shortest path of the above graph, the first step is note down all the edges which are given below:

(A, B), (A, C), (A, D), (B, E), (C, E), (D, C), (D, F), (E, F), (C, B)

Let's consider the source vertex as 'A'; therefore, the distance value at vertex A is 0 and the distance value at all the other vertices as infinity shown as below:



Since the graph has six vertices so it will have five iterations.

First iteration

Consider the edge (A, B). Denote vertex 'A' as 'u' and vertex 'B' as 'v'. Now use the relaxing formula:

$d(u) = 0$

$d(v) = \infty$

$c(u , v) = 6$

Since $(0 + 6)$ is less than ∞, so update

1. $d(v) = d(u) + c(u , v)$

$d(v) = 0 + 6 = 6$

Therefore, the distance of vertex B is 6.

Consider the edge (A, C). Denote vertex 'A' as 'u' and vertex 'C' as 'v'. Now use the relaxing formula:

$d(u) = 0$

$d(v) = \infty$

$c(u , v) = 4$

Since $(0 + 4)$ is less than ∞, so update

1. $d(v) = d(u) + c(u , v)$

$d(v) = 0 + 4 = 4$

Therefore, the distance of vertex C is 4.

Consider the edge (A, D). Denote vertex 'A' as 'u' and vertex 'D' as 'v'. Now use the relaxing formula:

$d(u) = 0$

$d(v) = \infty$

$c(u , v) = 5$

Since $(0 + 5)$ is less than ∞, so update

1. $d(v) = d(u) + c(u , v)$

$d(v) = 0 + 5 = 5$

Therefore, the distance of vertex D is 5.

Consider the edge (B, E). Denote vertex 'B' as 'u' and vertex 'E' as 'v'. Now use the relaxing formula:

$d(u) = 6$

$d(v) = \infty$

c(u , v) = -1

Since (6 - 1) is less than ∞, so update

1. d(v) = d(u) + c(u , v)

d(v) = 6 - 1= 5

Therefore, the distance of vertex E is 5.

Consider the edge (C, E). Denote vertex 'C' as 'u' and vertex 'E' as 'v'. Now use the relaxing formula:

d(u) = 4

d(v) = 5

c(u , v) = 3

Since (4 + 3) is greater than 5, so there will be no updation. The value at vertex E is 5.

Consider the edge (D, C). Denote vertex 'D' as 'u' and vertex 'C' as 'v'. Now use the relaxing formula:

d(u) = 5

d(v) = 4

c(u , v) = -2

Since (5 -2) is less than 4, so update

1. d(v) = d(u) + c(u , v)

d(v) = 5 - 2 = 3

Therefore, the distance of vertex C is 3.

Consider the edge (D, F). Denote vertex 'D' as 'u' and vertex 'F' as 'v'. Now use the relaxing formula:

d(u) = 5

d(v) = ∞

c(u , v) = -1

Since (5 -1) is less than ∞, so update

1. d(v) = d(u) + c(u , v)

d(v) = 5 - 1 = 4

Therefore, the distance of vertex F is 4.

Consider the edge (E, F). Denote vertex 'E' as 'u' and vertex 'F' as 'v'. Now use the relaxing formula:

d(u) = 5

d(v) = ∞

c(u , v) = 3

Since (5 + 3) is greater than 4, so there would be no updation on the distance value of vertex F.

Consider the edge (C, B). Denote vertex 'C' as 'u' and vertex 'B' as 'v'. Now use the relaxing formula:

d(u) = 3

d(v) = 6

c(u , v) = -2

Since (3 - 2) is less than 6, so update

1. d(v) = d(u) + c(u , v)

d(v) = 3 - 2 = 1

Therefore, the distance of vertex B is 1.

Now the first iteration is completed. We move to the second iteration.

Second iteration:

In the second iteration, we again check all the edges. The first edge is (A, B). Since (0 + 6) is greater than 1 so there would be no updation in the vertex B.

The next edge is (A, C). Since (0 + 4) is greater than 3 so there would be no updation in the vertex C.

The next edge is (A, D). Since (0 + 5) equals to 5 so there would be no updation in the vertex D.

The next edge is (B, E). Since (1 - 1) equals to 0 which is less than 5 so update:

d(v) = d(u) + c(u, v)

d(E) = d(B) +c(B , E)

= 1 - 1 = 0

The next edge is (C, E). Since (3 + 3) equals to 6 which is greater than 5 so there would be no updation in the vertex E.

The next edge is (D, C). Since (5 - 2) equals to 3 so there would be no updation in the vertex C.

The next edge is (D, F). Since (5 - 1) equals to 4 so there would be no updation in the vertex F.

The next edge is (E, F). Since (5 + 3) equals to 8 which is greater than 4 so there would be no updation in the vertex F.

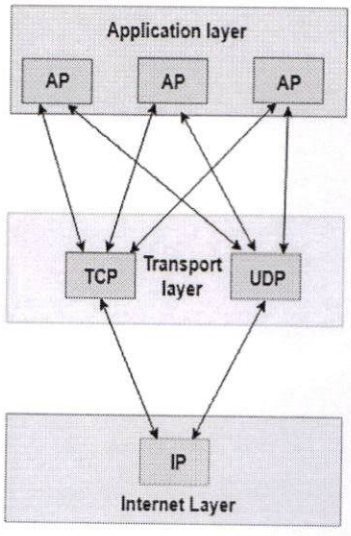
UNIT –IV

Transport Layer: Transport Services, Elements of Transport protocols,

Connection management, TCP and UDP protocols.

Transport Layer

- The transport layer is a 4th layer from the top.
- The main role of the transport layer is to provide the communication services directly to the application processes running on different hosts.
- The transport layer provides a logical communication between application processes running on different hosts. Although the application processes on different hosts are not physically connected, application processes use the logical communication provided by the transport layer to send the messages to each other.
- The transport layer protocols are implemented in the end systems but not in the network routers.
- A computer network provides more than one protocol to the network applications. For example, TCP and UDP are two transport layer protocols that provide a different set of services to the network layer.
- All transport layer protocols provide multiplexing/demultiplexing service. It also provides other services such as reliable data transfer, bandwidth guarantees, and delay guarantees.
- Each of the applications in the application layer has the ability to send a message by using TCP or UDP. The application communicates by using either of these two protocols. Both TCP and UDP will then communicate with the internet protocol in the internet layer. The applications can read and write to the transport layer. Therefore, we can say that communication is a two-way process.

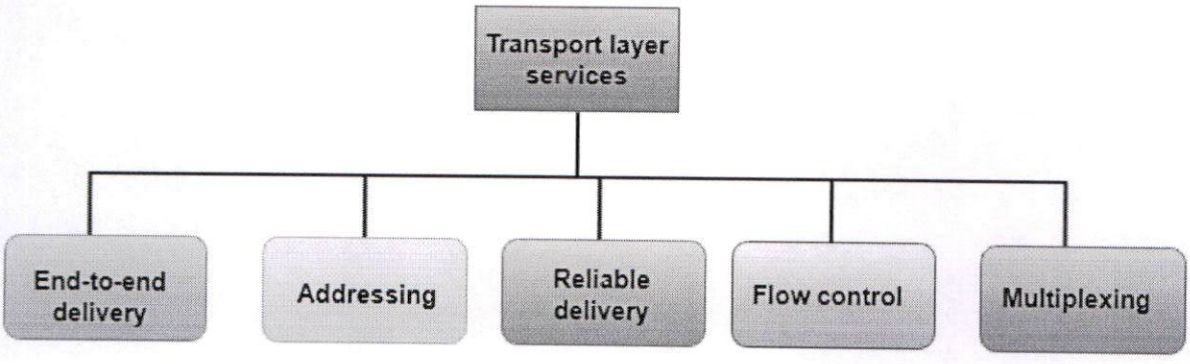


Services provided by the Transport Layer

The services provided by the transport layer are similar to those of the data link layer. The data link layer provides the services within a single network while the transport layer provides the services across an internetwork made up of many networks. The data link layer controls the physical layer while the transport layer controls all the lower layers.

The services provided by the transport layer protocols can be divided into five categories:

- End-to-end delivery
- Addressing
- Reliable delivery
- Flow control
- Multiplexing



End-to-end delivery:

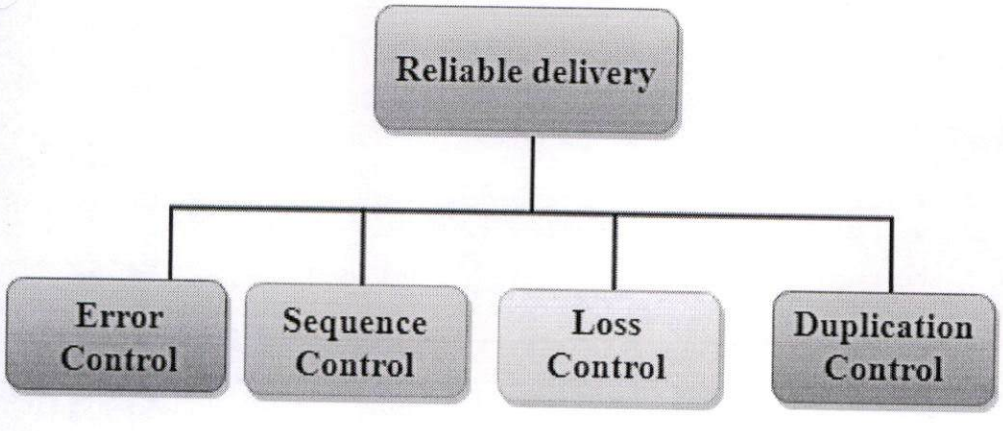
The transport layer transmits the entire message to the destination. Therefore, it ensures the end-to-end delivery of an entire message from a source to the destination.

Reliable delivery:

The transport layer provides reliability services by retransmitting the lost and damaged packets.

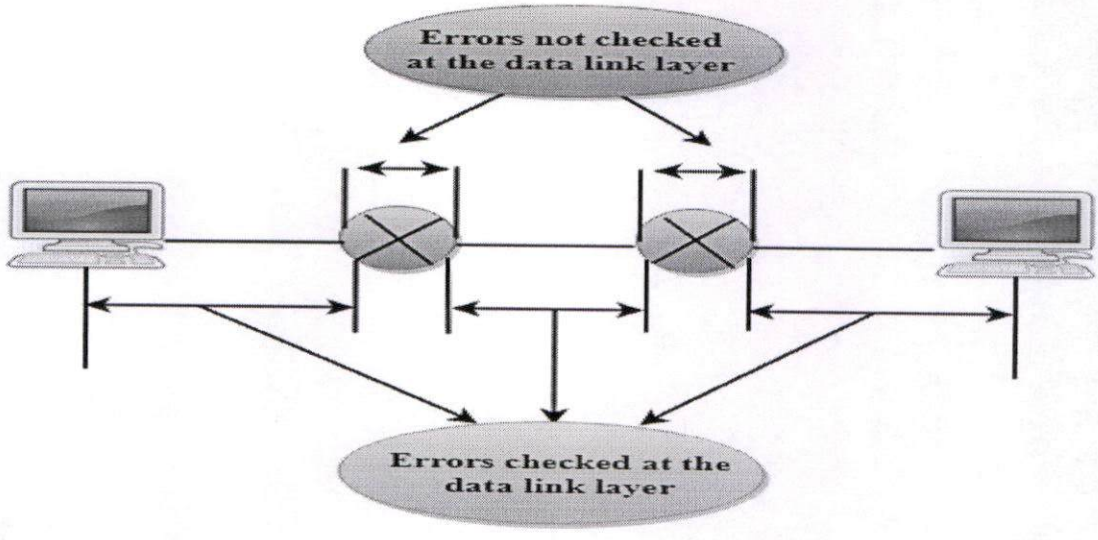
The reliable delivery has four aspects:

- Error control
- Sequence control
- Loss control
- Duplication control



Error Control

- The primary role of reliability is **Error Control**. In reality, no transmission will be 100 percent error-free delivery. Therefore, transport layer protocols are designed to provide error-free transmission.
- The data link layer also provides the error handling mechanism, but it ensures only node-to-node error-free delivery. However, node-to-node reliability does not ensure the end-to-end reliability.
- The data link layer checks for the error between each network. If an error is introduced inside one of the routers, then this error will not be caught by the data link layer. It only detects those errors that have been introduced between the beginning and end of the link. Therefore, the transport layer performs the checking for the errors end-to-end to ensure that the packet has arrived correctly.



Sequence Control

- The second aspect of the reliability is sequence control which is implemented at the transport layer.
- On the sending end, the transport layer is responsible for ensuring that the packets received from the upper layers can be used by the lower layers. On the receiving end, it ensures that the various segments of a transmission can be correctly reassembled.

Loss Control

Loss Control is a third aspect of reliability. The transport layer ensures that all the fragments of a transmission arrive at the destination, not some of them. On the sending end, all the fragments of transmission are given

sequence numbers by a transport layer. These sequence numbers allow the receiver?s transport layer to identify the missing segment.

Duplication Control

Duplication Control is the fourth aspect of reliability. The transport layer guarantees that no duplicate data arrive at the destination. Sequence numbers are used to identify the lost packets; similarly, it allows the receiver to identify and discard duplicate segments.

Flow Control

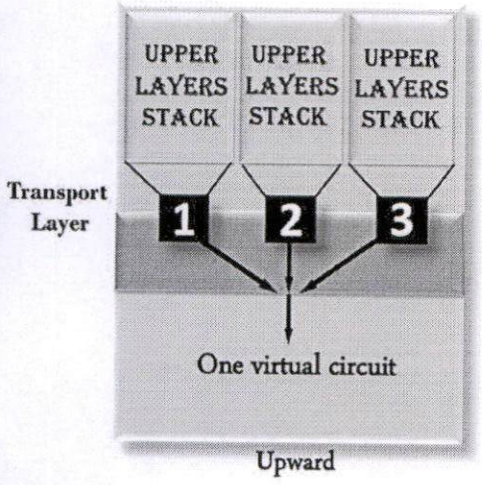
Flow control is used to prevent the sender from overwhelming the receiver. If the receiver is overloaded with too much data, then the receiver discards the packets and asking for the retransmission of packets. This increases network congestion and thus, reducing the system performance. The transport layer is responsible for flow control. It uses the sliding window protocol that makes the data transmission more efficient as well as it controls the flow of data so that the receiver does not become overwhelmed. Sliding window protocol is byte oriented rather than frame oriented.

Multiplexing

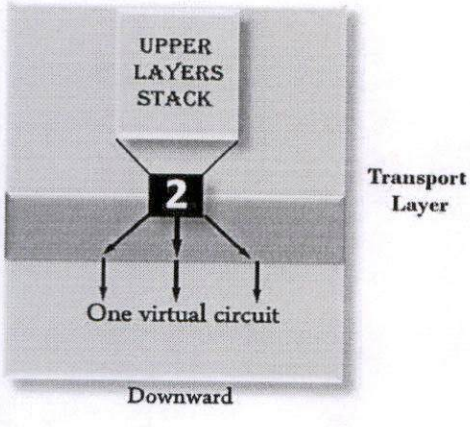
The transport layer uses the multiplexing to improve transmission efficiency.

Multiplexing can occur in two ways:

- **Upward multiplexing:** Upward multiplexing means multiple transport layer connections use the same network connection. To make more cost-effective, the transport layer sends several transmissions bound for the same destination along the same path; this is achieved through upward multiplexing.



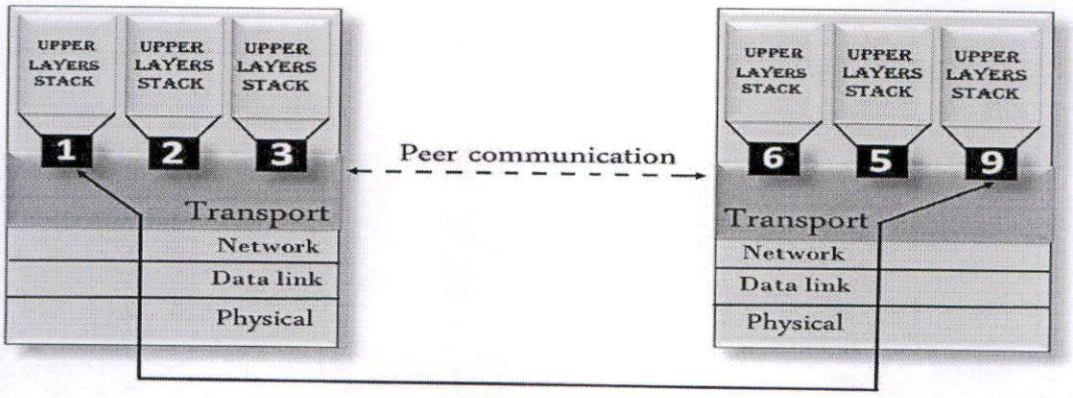
- **Downward multiplexing:** Downward multiplexing means one transport layer connection uses the multiple network connections. Downward multiplexing allows the transport layer to split a connection among several paths to improve the throughput. This type of multiplexing is used when networks have a low or slow capacity.



Addressing

- According to the layered model, the transport layer interacts with the functions of the session layer. Many protocols combine session, presentation, and application layer protocols into a single layer known as the application layer. In these cases, delivery to the session layer means the delivery to the application layer. Data generated by an application on one machine must be transmitted to the correct application on another machine. In this case, addressing is provided by the transport layer.

- The transport layer provides the user address which is specified as a station or port. The port variable represents a particular TS user of a specified station known as a Transport Service access point (TSAP). Each station has only one transport entity.
- The transport layer protocols need to know which upper-layer protocols are communicating.



ELEMENTS OF TRANSPORT LAYER:

At the data link layer, two routers communicate directly via a physical channel, whether wired or wireless, whereas at the transport layer, this physical channel is replaced by the entire network. This difference has many important implications for the protocols.

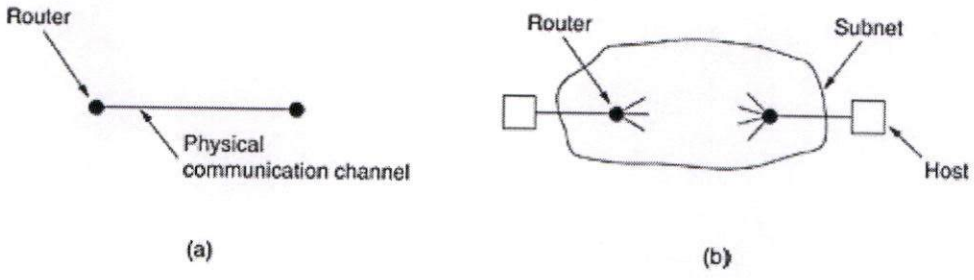


Figure (a) Environment of the data link layer. (b) Environment of the transport layer.

1. Addressing
2. Connection Establishment
3. Connection Release
4. Flow Control and Buffering
5. Multiplexing

1. ADDRESSING

When an application (e.g., a user) process wishes to set up a connection to a remote application process, it must specify which one to connect to. The method normally used is to define transport addresses to which processes can listen for connection requests. In the Internet, these endpoints are called **ports**.

There are two types of access points.

TSAP (Transport Service Access Point) to mean a specific endpoint in the transport layer.

The analogous endpoints in the network layer (i.e., network layer addresses) are not surprisingly called **NSAPs (Network Service Access Points).** IP addresses are examples of NSAPs.

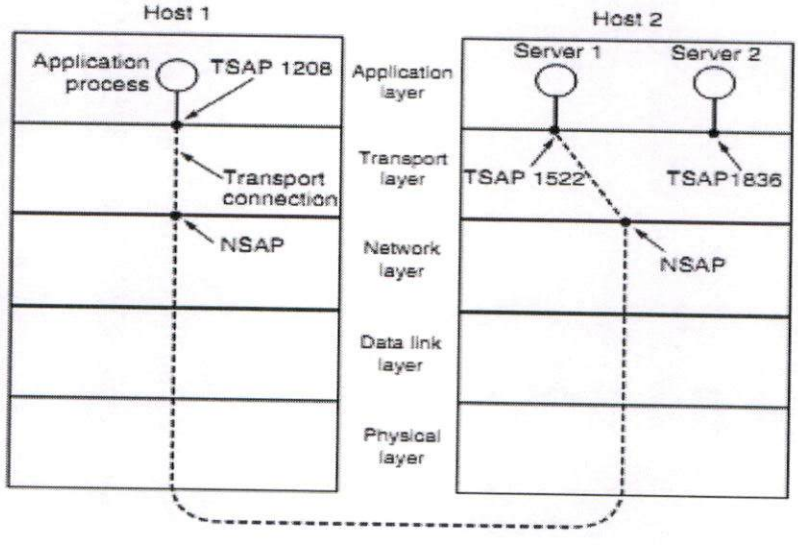


Fig 4.5: TSAP and NSAP network connections

Application processes, both clients and servers, can attach themselves to a local TSAP to establish a connection to a remote TSAP. These connections run through NSAPs on each host. The purpose of having TSAPs is that in some networks, each computer has a single NSAP, so some way is needed to distinguish multiple transport endpoints that share that NSAP.

A possible scenario for a transport connection is as follows:

1. A mail server process attaches itself to TSAP 1522 on host 2 to wait for an incoming call. How a process attaches itself to a TSAP is outside the networking model and depends entirely on the local operating system. A call such as our LISTEN might be used, for example.
2. An application process on host 1 wants to send an email message, so it attaches itself to TSAP 1208 and issues a CONNECT request. The request specifies TSAP 1208 on host 1 as the source and TSAP 1522 on host 2 as the destination. This action ultimately results in a transport connection being established between the application process and the server.
3. The application process sends over the mail message.
4. The mail server responds to say that it will deliver the message.
5. The transport connection is released.

CONNECTION MANAGEMENT

2. CONNECTION ESTABLISHMENT:

With packet lifetimes bounded, it is possible to devise a fool proof way to establish connections safely. Packet lifetime can be bounded to a known maximum using one of the following techniques:

- Restricted subnet design
- Putting a hop counter in each packet
- Time stamping in each packet

Using a 3-way hand shake, a connection can be established. This establishment protocol doesn't require both sides to begin sending with the same sequence number.

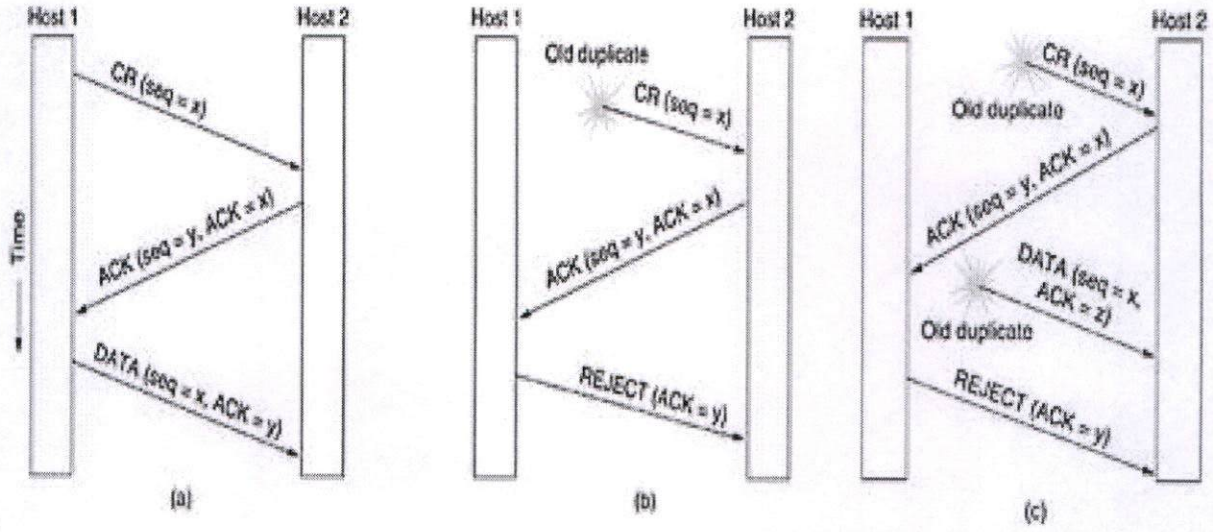


Fig 4.6: Three protocol scenarios for establishing a connection using a three-way handshake. CR denotes CONNEC TION REQUEST (a) Normal operation. (b) Old duplicate CONNECTION REQUEST appearing out of nowhere. (c) Duplicate CONNECTION REQUEST and duplicate ACK .

- The **first technique** includes any method that prevents packets from looping, combined with some way of bounding delay including congestion over the longest possible path. It is difficult, given that internets may range from a single city to international in scope.

- The **second method** consists of having the hop count initialized to some appropriate value and decremented each time the packet is forwarded. The network protocol simply discards any packet whose hop counter becomes zero.
- The **third method** requires each packet to bear the time it was created, with the routers agreeing to discard any packet older than some agreed-upon time.

In **fig (A)** Tomlinson (1975) introduced the **three-way handshake**.

- This establishment protocol involves one peer checking with the other that the connection request is indeed current. Host 1 chooses a sequence number, x , and sends a CONNECTION REQUEST segment containing it to host 2. Host 2replies with an ACK segment acknowledging x and announcing

UNIT -V

Application Layer–Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

Domain Name System

- ✓ Domain Name System(DNS) is an application layer protocol for message exchange between clients and servers.
- ✓ Domain Name System(DNS) is an Internet service that translates domain names into IP addresses.
- ✓ The domain name system (DNS) is a naming database in which internet domain names are located and translated into Internet Protocol (IP) addresses.
- ✓ DNS has some protocols that allow the client and servers to communicate with each other.

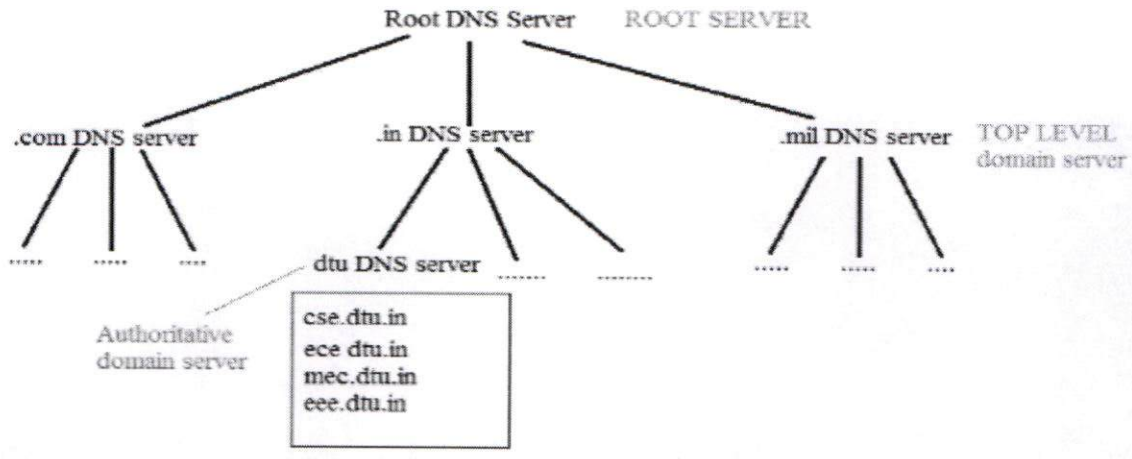
For example, if someone types "bktechsoft.com" into a web browser, a server behind the scenes maps that name to the corresponding IP address. An IP address is similar in structure to 203.0.113.72.

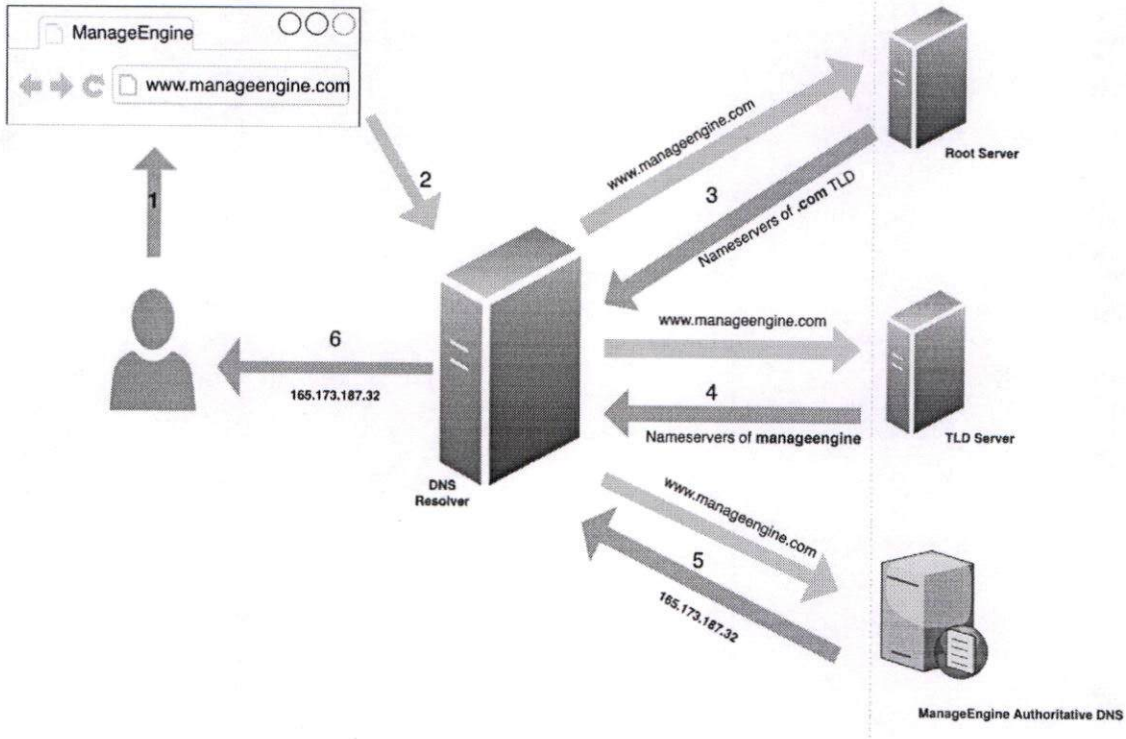
What is the Need of DNS?

Every host is identified by the IP address but remembering numbers is very difficult for people also the IP addresses are not static therefore a mapping is required to change the domain name to the IP address. So DNS is used to convert the domain name of the websites to their numerical IP address.

How Does DNS Work?

The working of DNS starts with converting a hostname into an IP Address. A domain name serves as a distinctive identification for a website. It is used in place of an IP address to make it simpler for consumers to visit websites. Domain Name System works by executing the database whose work is to store the name of hosts which are available on the Internet. The top-level domain server stores address information for top-level domains such as .com and .net, .org, and so on. If the Client sends the request, then the DNS resolver sends a request to DNS Server to fetch the IP Address. In case, when it does not contain that particular IP Address with a hostname, it forwards the request to another DNS Server. When IP Address has arrived at the resolver, it completes the request over Internet Protocol.


Root DNS Server
ROOT SERVER
.com DNS server
.in DNS server
.mil DNS server
TOP LEVEL
domain server
dtu DNS server
Authoritative
domain server
cse.dtu.in
ece dtu.in
mec.dtu.in
eee.dtu.in


ManageEngine
www.manageengine.com
1
2
3
www.manageengine.com
Nameservers of .com TLD
Root Server
6
165.173.187.32
www.manageengine.com
4
Nameservers of manageengine
TLD Server
DNS
Resolver
www.manageengine.com
5
165.173.187.32
ManageEngine Authoritative DNS

Types of DNS in the Internet

- DNS is a protocol that can be used in different platform.
- Domain Name Space is divided into different sections in the Internet:
  1. Generic domain,
  2. Country domain and
  3. Inverse domain.

1) Generic Domains

The generic domains define registered hosts according to their generic behaviour.

Examples:

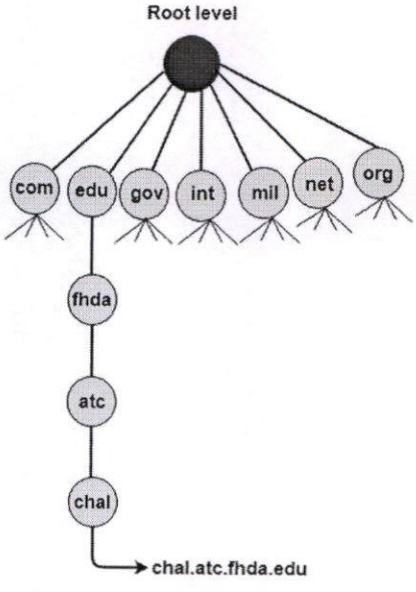
.com(commercial),

.edu(educational),

.mil(military),

.org(nonprofit organization),

.net(similar to commercial).



2) Country Domains

- ✓ Country domain uses two character country abbreviations.
- ✓ Second labels can be more specific, national designation.
- ✓ **For example,** for India the country domain is .in, for Australia is .au, UK is .uk etc.

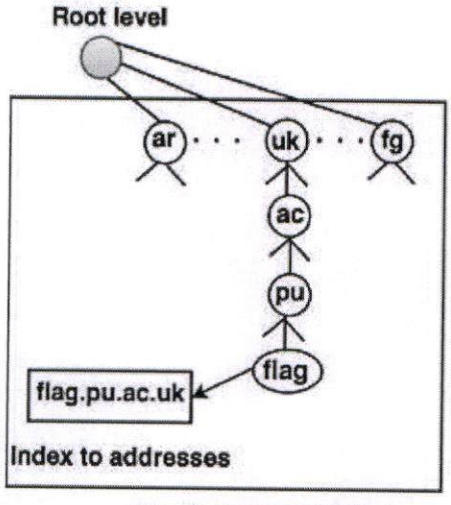


Fig: Country domains

3) Inverse Domains

- Inverse domain is used to map an address to a name.
- **For example,** a client send a request to the server for performing a particular task, server finds a list of authorized client. The list contains only IP addresses of the client.
- The server sends a query to the DNS server to map an address to a name to determine if the client is on the authorized list.
- This query is called an inverse query.
- This query is handled by first level node called arpa.

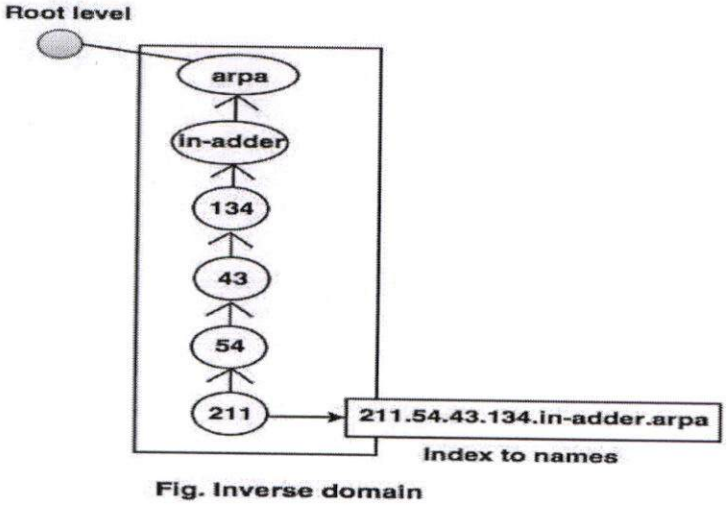


Fig. Inverse domain

Reference:

https://www.geeksforgeeks.org/domain-name-system-dns-in-application-layer/

Simple Network Management Protocol (SNMP)

If an organization has 1000 of devices then to check all devices, one by one every day, are working properly or not is a hectic task. To ease these up, Simple Network Management Protocol (SNMP) is used.

Simple Network Management Protocol (SNMP) –

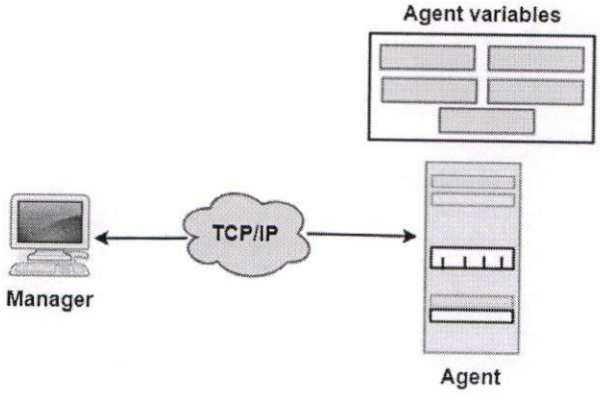
1 .SNMP stands for **Simple Network Management Protocol.**

2. SNMP is an application layer protocol which uses UDP (Connectionless) port number 161/162

3. SNMP is a framework used for managing devices on the internet.

4. It provides a set of operations for monitoring and managing the internet.

SNMP Concept

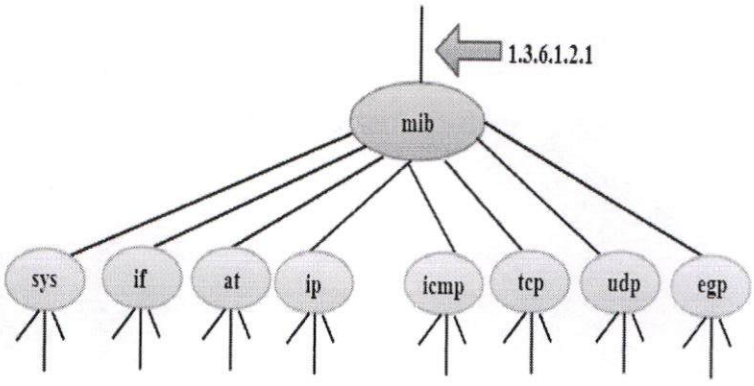


- SNMP has two components Manager and agent MIB.
- The manager is a host that controls and monitors a set of agents such as routers.
- It is an application layer protocol in which a few manager stations can handle a set of agents.
- It is used in a heterogeneous (Different) network made of different LANs and WANs connected by routers or gateways.

SNMP components –

There are 3 components of SNMP:

1. **SNMP Manager –**
   It is a centralised system used to monitor network. It is also known as Network Management Station (NMS)
2. **SNMP agent –**
   It is a software management software module installed on a managed device. Managed devices can be network devices like router, switches, servers etc.
3. **Management Information Base –**
   MIB consists of information of resources that are to be managed. These information is organised hierarchically. It consists of objects instances which are essentially variables.

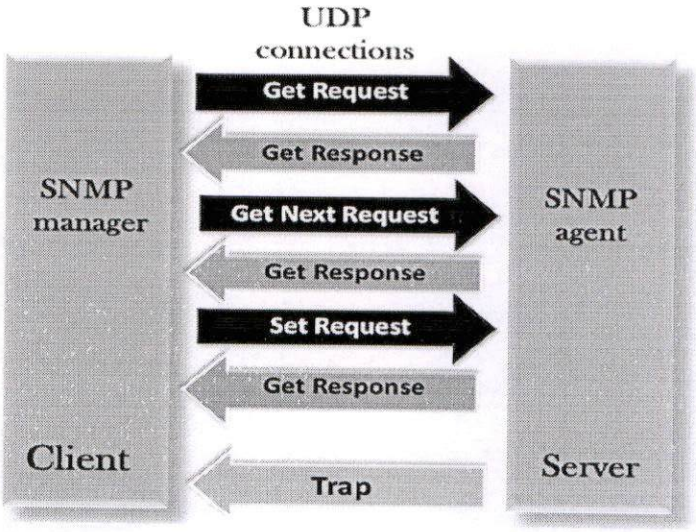


SNMP messages –

Different variables are:

1. **GetRequest –**
   SNMP manager sends this message to request data from SNMP agent. It is simply used to retrieve data from SNMP agent. In response to this, SNMP agent responds with requested value through response message.
2. **GetNextRequest –**
   This message can be sent to discover what data is available on a SNMP agent. The SNMP manager can request for data continuously until no more data is left. In this way, SNMP manager can take knowledge of all the available data on SNMP agent.
3. **GetBulkRequest –**
   This message is used to retrieve large data at once by the SNMP manager from SNMP agent.
4. **SetRequest –**
   It is used by SNMP manager to set the value of an object instance on the SNMP agent.
5. **Response –**
   It is a message send from agent upon a request from manager. When sent in response to Get messages, it will contain the data requested. When sent in response to Set message, it will contain the newly set value as confirmation that the value has been set.
6. **Trap –**
   These are the message send by the agent without being requested by the manager. It is sent when a fault has occurred.

7. **InformRequest –**
   It was introduced in SNMPv2, used to identify if the trap message has been received by the manager or not.



SNMP security levels –

It defines the type of security algorithm performed on SNMP packets. These are used in only SNMPv3.

There are 3 security levels namely:

1. **noAuthNoPriv-**
   This (no authentication, no privacy) security level uses community string for no authentication and no encryption for privacy.
2. **authNopriv –**
   This security level (authentication, no privacy) uses HMAC (Hashing for Message **Authentication code**) with Md5 (Message Digest Algorithm 5) for authentication and no encryption is used for privacy.
3. **authPriv –**
   This security level (authentication, privacy) uses HMAC with Md5 or SHA (**Secure** Hash Algorithm) for authentication and encryption uses DES-56(Data Encryption Standard) algorithm.

SNMP versions –

There are 3 versions of SNMP:

1. **SNMPv1 –**
   It uses community strings for authentication and use UDP only.
2. **SNMPv2–**
   It uses community strings for authentication. It uses UDP but can be configured to use TCP.
3. **SNMPv3 –**
   It uses Hash based MAC with MD5 or SHA for authentication and DES-56 for privacy. This version uses TCP. Therefore, conclusion is the higher the version of SNMP, more secure it will be.

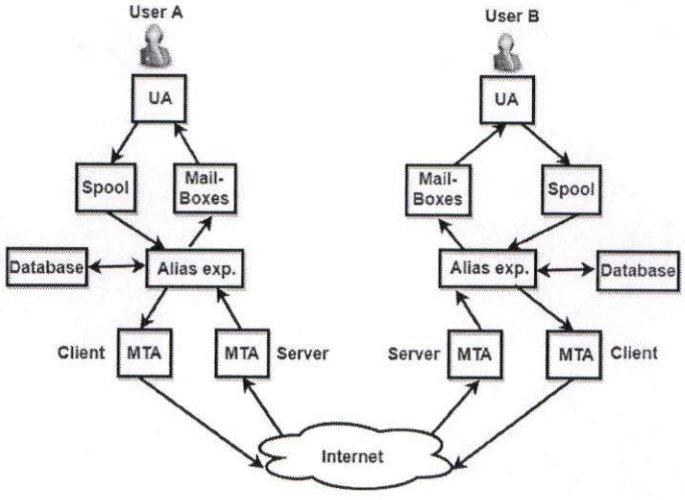
Electronic Mail

Electronic Mail (e-mail) is one of most widely used services of Internet. This service allows an Internet user to send a **message in formatted manner (mail)** to the other Internet user in any part of world.

Components of E-Mail System :
The basic components of an email system are : User Agent (UA), Message Transfer Agent (MTA), Mail Box, and Spool file. These are explained as following below.

1. **User Agent (UA) :**
   The UA is normally a program which is used to send and receive mail. Sometimes, it is called as mail reader. It accepts variety of commands for composing, receiving and replying to messages as well as for manipulation of the mailboxes.

2. **Message Transfer Agent (MTA) :**
   MTA is actually responsible for transfer of mail from one system to another. To send a mail, a system must have client MTA and system MTA. It transfer mail to mailboxes of recipients if they are connected in the same machine. It delivers mail to peer MTA if destination mailbox is in another machine. The delivery from one MTA to another MTA is done by Simple Mail Transfer Protocol.



3. **Mailbox :**
   It is a file on local hard drive to collect mails. Delivered mails are present in this file. The user can read it delete it according to his/her requirement. To use e-mail system each user must have a mailbox . Access to mailbox is only to owner of mailbox.
4. **Spool file :**
   This file contains mails that are to be sent. User agent appends outgoing mails in this file using SMTP. MTA extracts pending mail from spool file for their delivery. E-mail allows one name, an alias, to represent several different e-mail addresses. It is known as mailing list, Whenever user have to sent a message, system checks recipients's name against alias database. If mailing list is present for defined alias, separate messages, one for each entry in the list, must be prepared and handed to MTA. If for defined alias, there is no such mailing list is present, name itself becomes naming address and a single message is delivered to mail transfer entity.

Services provided by E-mail system:

- **Composition –**
  The composition refer to process that creates messages and answers. For composition any kind of text editor can be used.
- **Transfer –**
  Transfer means sending procedure of mail i.e. from the sender to recipient.
- **Reporting –**
  Reporting refers to confirmation for delivery of mail. It help user to check whether their mail is delivered, lost or rejected.
- **Displaying –**
  It refers to present mail in form that is understand by the user.
- **Disposition –**
  This step concern with recipient that what will recipient do after receiving mail i.e. save mail, delete before reading or delete after reading.

E-Mail Format

Electronic Mail (e-mail) is one of the most widely used services of the Internet. This service allows an Internet user to send a **message in a formatted manner (mail)** to other Internet users in any part of the world. Message in the mail not only contain text, but it also contains images, audio and videos data. The person who is sending mail is called **sender** and person who receives mail is called the **recipient**. It is just like postal mail service.

Format of E-mail :

An e-mail consists of three parts that are as follows :

1. Envelope
2. Header
3. Body

These are explained as following below.

1. Envelope :

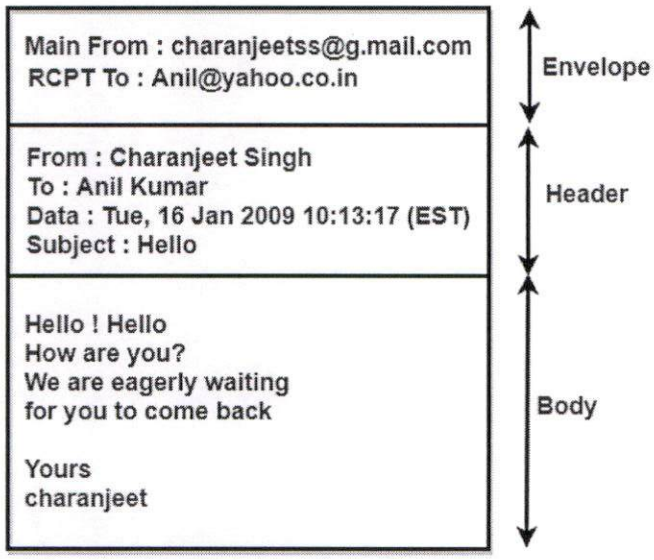
The envelope part encapsulates the message. It contains all information that is required for sending any e-mail such as destination address, priority and security level. The envelope is used by MTAs for routing message.

2. Header :

The header consists of a series of lines. Each header field consists of a single line of ASCII text specifying field name, colon and value. The main header fields related to message transport are :

1. **To:** It specifies the DNS address of the primary recipient(s).
2. **Cc :** It refers to carbon copy. It specifies address of secondary recipient(s).
3. **BCC:** It refers to blind carbon copy. It is very similar to Cc. The only difference between Cc and Bcc is that it allow user to send copy to the third party without primary and secondary recipient knowing about this.
4. **From :** It specifies name of person who wrote message.
5. **Sender :** It specifies e-mail address of person who has sent message.
6. **Received :** It refers to identity of sender's, data and also time message was received. It also contains the information which is used to find bugs in routing system.
7. **Return-Path:** It is added by the message transfer agent. This part is used to specify how to get back to the sender.

3. Body:- The body of a message contains text that is the actual content/message that needs to be sent, such as "Employees who are eligible for the new health care program should contact their supervisors by next Friday if they want to switch." The message body also may include signatures or automatically generated text that is inserted by the sender's email system.
The above-discussed field is represented in tabular form as follows :



Advantages and Disadvantages of E-mail

1. E-mails provides faster and easy mean of communication. One can send message to any person at any place of world by just clicking mouse.
2. Various folders and sub-folders can be created within inbox of mail, so it provide management of messages.
3. It is effective and cheap means of communication because single message can be send to multiple people at same time.
4. E-mails are very easy to filter. User according to his/her priority can prioritize e-mail by specifying subject of e-mail.
5. E-mail is not just only for textual message. One can send any kind of multimedia within mail.

Disadvantages of E-mail :

1. It is source of viruses. It is capable to harm one's computer and read out user's e-mail address book and send themselves to number of people around the world.
2. It can be source of various spams. These spam mails can fill up inbox and to deletion of these mail consumes lot of time.
3. It is informal method of communication. The documents those require signatures are not managed by e-mail.

Difference table between IMAP and POP3

Unit-I

COMPUTER NETWORKS

Dr.S.KIRUBAKARAN., M.E, Ph.D.,
Professor/CSE

Unit-I

Introduction: Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

Unit-I

- Network hardware
- Network software
- OSI Reference Model
- TCP/IP Reference models
- Example Networks: ARPANET, Internet

Unit-I

- Physical Layer
- Guided Transmission media
- Twisted pairs
- Coaxial cable
- Fiber optics
- Wireless transmission

Computer Network – It is a interconnected collection of autonomous computers.

- Interconnected – Two computers are said to be interconnected if they are able to exchange information.

USES OF COMPUTER NETWORKS

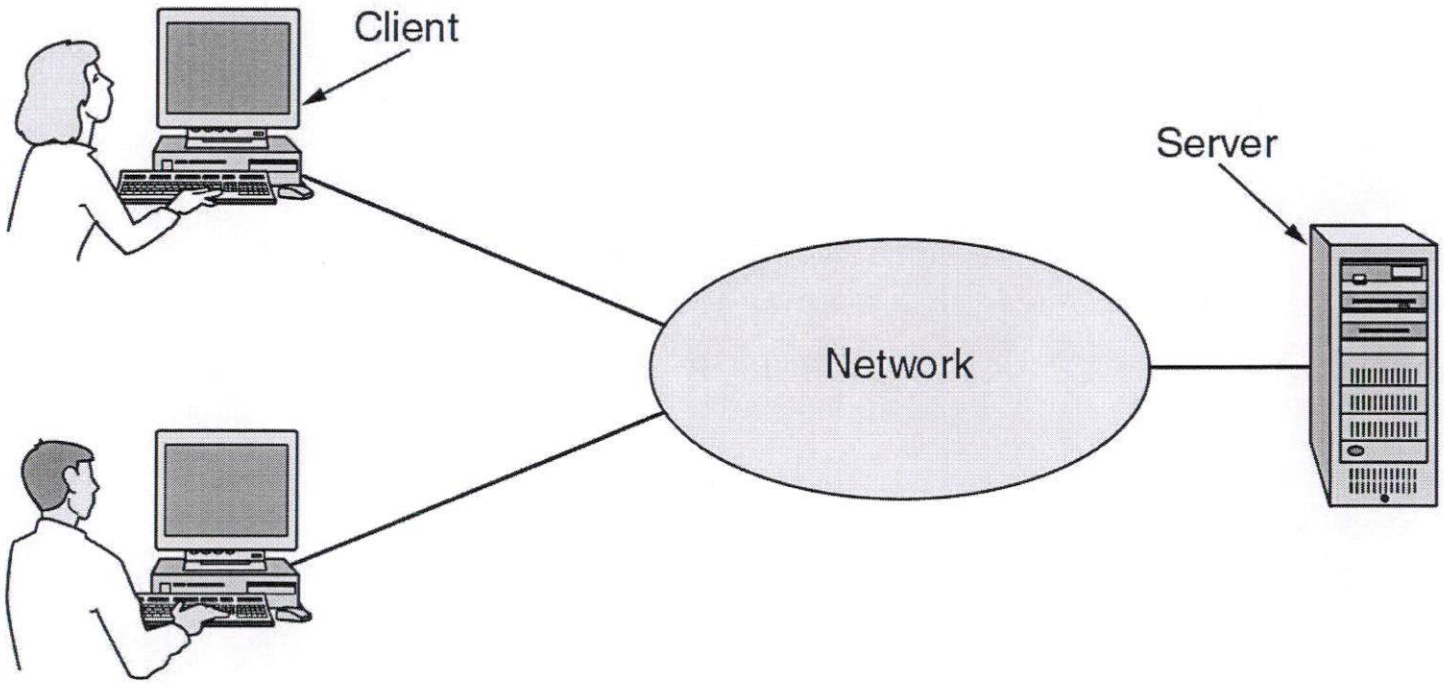
- Network for companies
- Network for people

Network for companies.

- Resource sharing :- it's goal is to make all programs, equipment, and especially data available to anyone without regard to the physical location of the resource and the user.
- High reliability :- by having alternative sources of supply. For example, all files could be replicated on two or three machines, so if one of them is unavailable (due to hardware failure), the other copies could be used.
- Scalability :- the ability to increase system performance gradually as the workload grows just by adding more processors. In contrast mainframes must be replaced by larger ones, which is costly.

Business Applications of Networks

- A network with two clients and one server.



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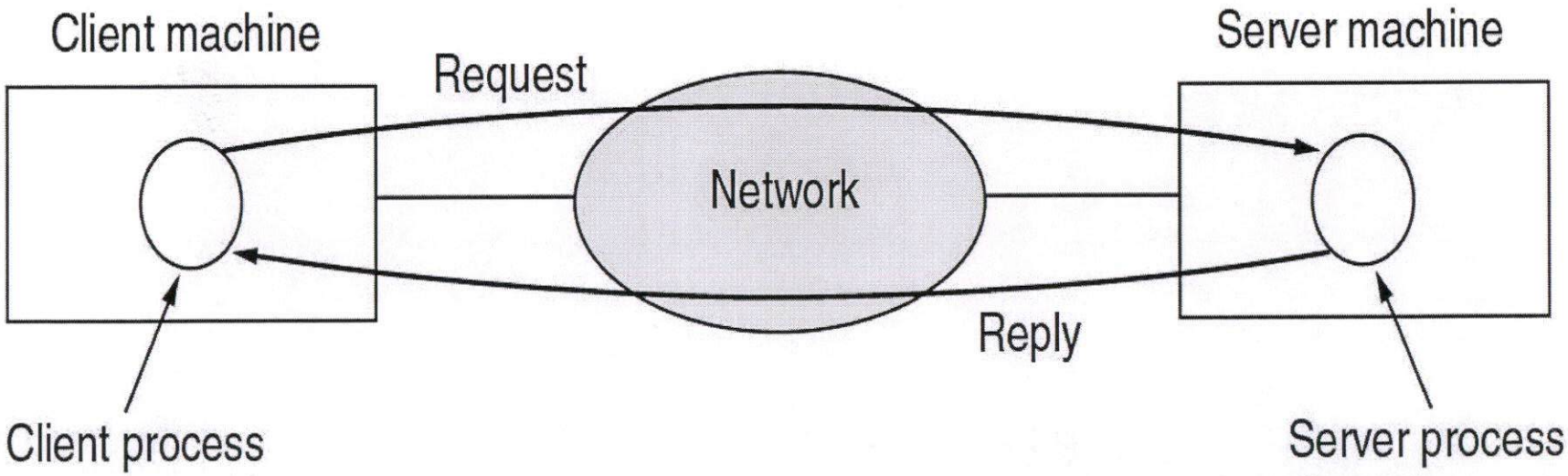
- Communication medium :- using a network, it is easy for two or more people who live far apart to write a report together. When one worker makes a change to an on-line document, the others can see the changes immediately. Exa. Railway reservation.

- Saving money :- small computers have a much better price/performance ratio than larger ones (mainframes).

- Client server model is very low in cost.

Client server model

In this model, the users are called clients and the data are kept on one or more shared file server machines.



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- Interactive entertainment :- online games, online quiz shows etc.
- Electronic commerce :- online bill payment, managing bank accounts, ticket reservation, home shopping etc.
- Online exams.
- Online news papers.
- Online televisions channels.
- Online study etc.

Networks for People

- Access to remote information :- access to information systems like the current World Wide Web, which contains information about the arts, business, health, history, science, sports, government etc.
- Person-to-person communication :-
- (a)Electronic mail (E-mail) is already widely used by millions of people.
- (b)Real-time email will allow remote users to communicate with no delay, possibly seeing and hearing each other as well.
- (c)video-conference.

Broadcast networks

- Broadcast networks have a single communication channel that is shared by all the machines on the network.
- Short messages, called packets in certain contexts, sent by any machines are received by all the others.
- An address field within the packet specifies for whom it is intended.
- Upon receiving a packet, a machine checks the address field. If the packet is intended for itself, it processes the packet otherwise it is ignored.

Network hardware

- The networks are examined under two categories:
  (1) Transmission technology.
  (2) Scale.

- Transmission technology: Broadly speaking, there are two types of transmission technology
  - ✔ Broadcast networks.
  - ✔ Point-to-point networks.

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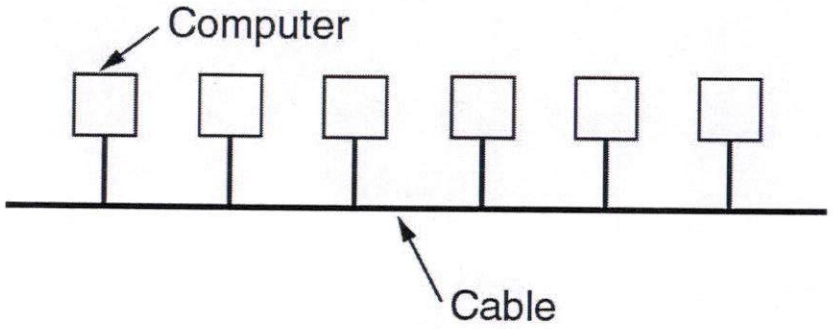
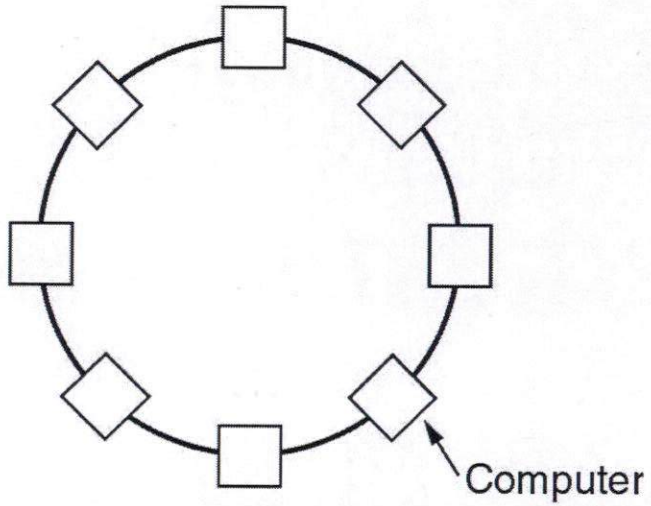


(a)



(b)

Two broadcast networks

(a) Bus

(b) Ring

- Broadcasting :- Broadcast systems generally also allow the possibility of addressing a packet to all destinations by using a special code in the address field. When a packet with this code is transmitted, it is received and processed by every machine on the network. This mode of operation is called broadcasting.

- Multicasting :- Some broadcast systems also support transmission to a subset of the machines, which is known as multicasting.

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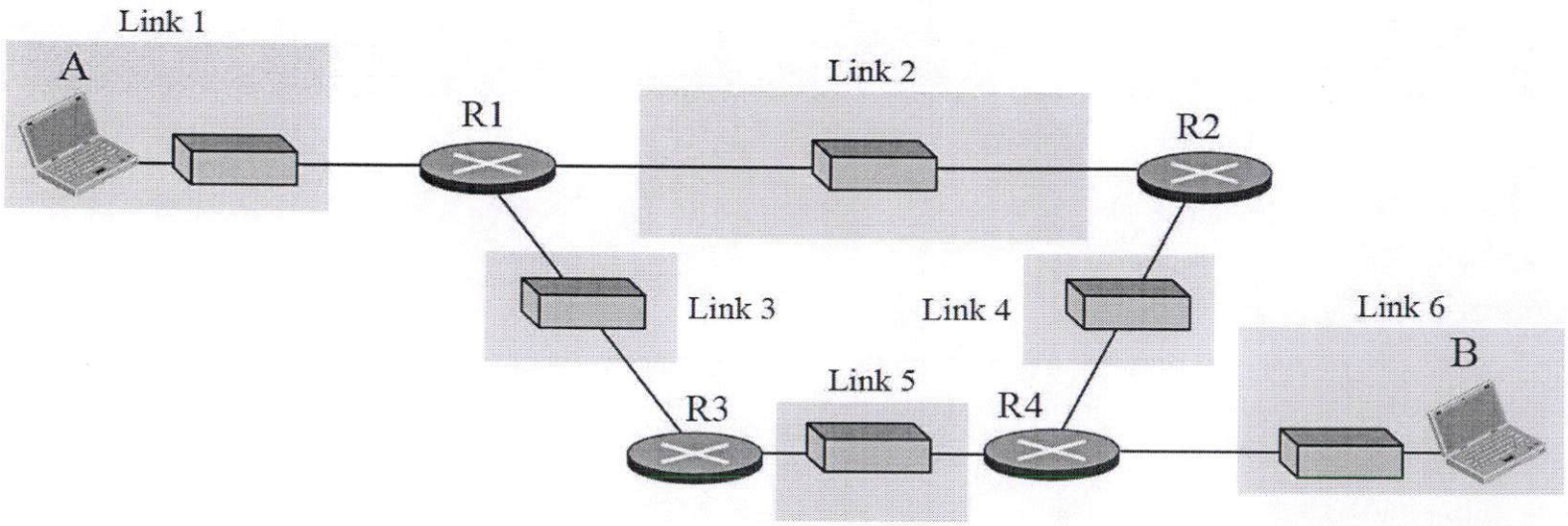
- Often multiple routes, of different lengths are possible, so routing algorithms play an important role in point-to-point networks.



Local Area Networks

- Local Area Networks (LANs) are privately owned networks within a single building or campus of up to a few kilometers in size.
- They are widely used to connect personal computers and workstations in company offices and factories to share resources (e.g., printers) and exchange information.
- LANs are distinguished from other kinds of networks by three characteristics:

✔ Size
✔ Transmission technology
✔ Topology

Point-to-point networks

- Point-to-point networks consist of many connections betweenindividuals pairs of machines.

- To go from the source to the destination, a packet on this type of network may have to first visit one or more intermediate machines.

Network Classification As per Scale

- An alternative criterion for classifying network is their scale.

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Classification of interconnected processors by scale

Unit-II

COMPUTER NETWORKS

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Unit-II

- Data link layer
- Design issues
- Framing
- Error detection and correction.
- Elementary data link protocols
- Simplex protocol
- A simplex stop and wait protocol for an error-free channel
- A simplex stop and wait protocol fornoisy channel.

Data Link Layer

Unit-II

- Sliding Window protocols
- A one-bit sliding window protocol
- A protocol using Go-Back-N
- A protocol using Selective Repeat
- Example data link protocols.
- Medium Access sub layer
- The channel allocation problem
- Multiple access protocols
- ALOHA
- Carrier sense multiple access protocols
- Collision free protocols
- Wireless LANs
- Data link layer switching

Data Link Layer

- Functions of Data Link Layer
  - ✔ Framing
  - ✔ Flow Control
  - ✔ Error Control
  - ✔ Access Control
  - ✔ Physical Addressing

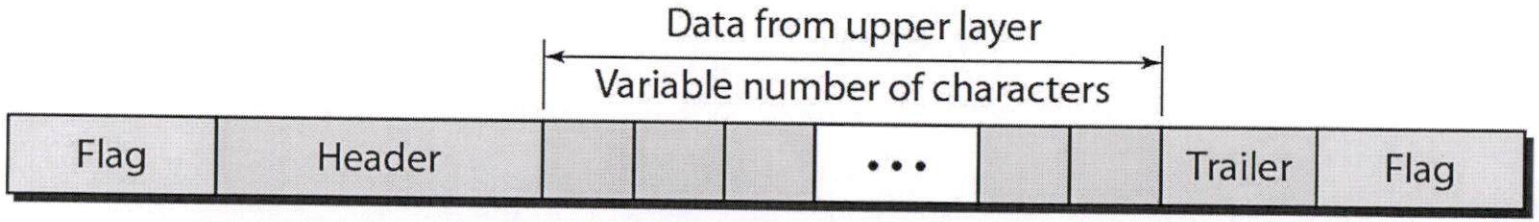
Data Link Layer

- Framing

- The data link layer divides the stream of bits received from the network layer into manageable data units called as frames.
- The formation of frames can be broadly categorized into two types.
  - Fixed-Size Framing
  - Variable-Size Framing

Data Link Layer

- Character-Oriented Approach
- A frame in character-oriented protocolhas been shown in below figure.



- To separate one frame from another an 8-bit flag is added at the beginning and the end of the frame.

Data Link Layer

- Fixed-Size Framing
  - There is no need of delimiting the boundaries of the frame.
  - The predefined size can be used as the delimiter for the Frames.
- Variable-Size Framing
  - There is a need to define the end of one frame and the beginning of the next frame.
  - Two different approaches have been used for have variable-size frames. They are
    - Character-Oriented Approach
    - Bit-Oriented Approach

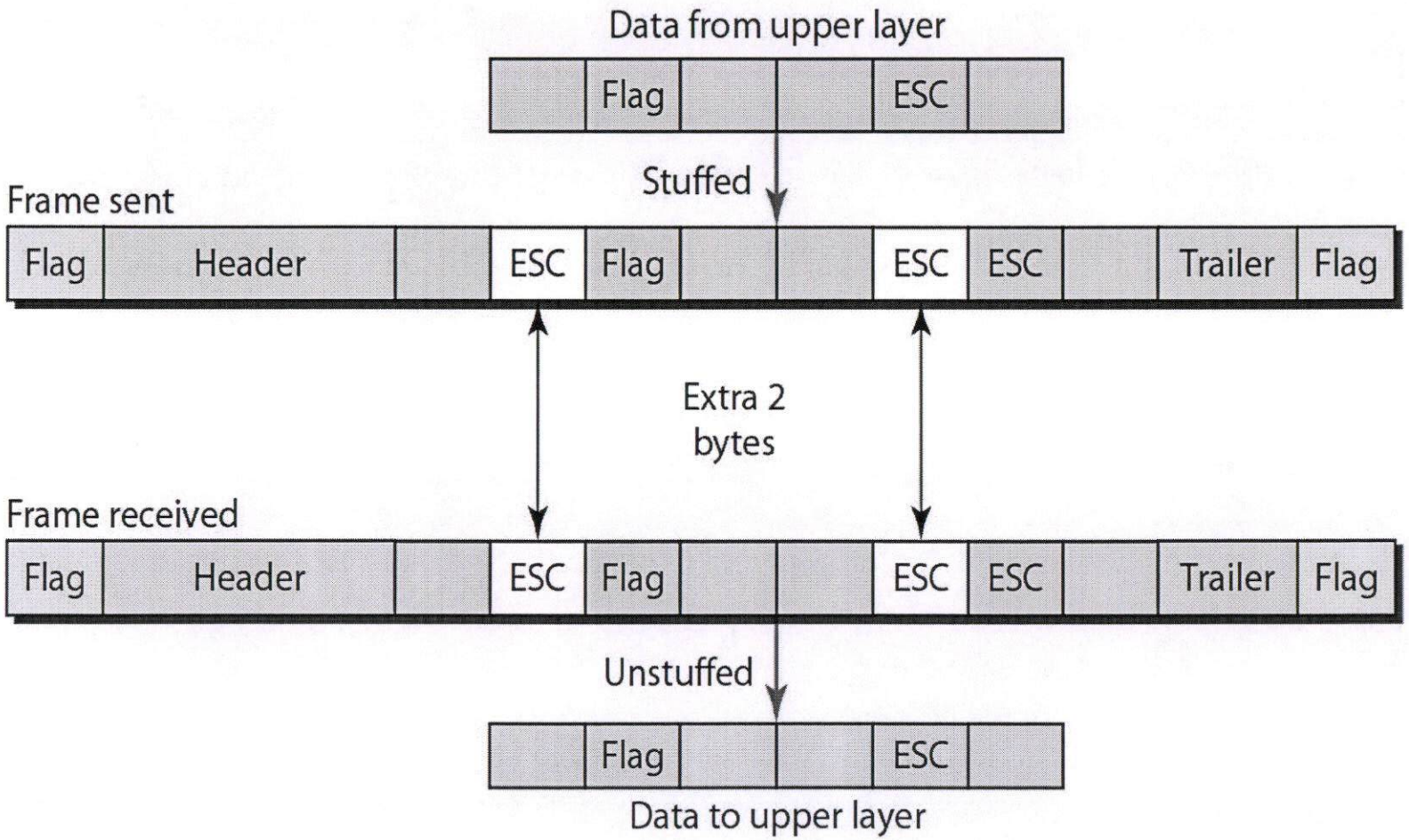
Data Link Layer

- The header contains the source and destination address and control information.
- The trailer contains the error detection or error correction bits.
- The flag could be selected to be any character.
- Any pattern used for the flag could appear in the information.
- When the receiver encounters the flag pattern in the middle of the data, it thinks that it has reached the end of the frame.

Data Link Layer

- To overcome this problem a byte-stuffing strategy has been added to the character-oriented framing.
- A special byte has been added to the data section of the frame whenever there is a character with the same pattern as that of flag.
- The data link layer at the sender site insert a special character called as escape byte (ESC) just before each "accidental" flag byte in the data.

Data Link Layer



Data Link Layer

- When ever the receiver encounters the ESC character it removes it from the data section and treats the next character as data not as flag.

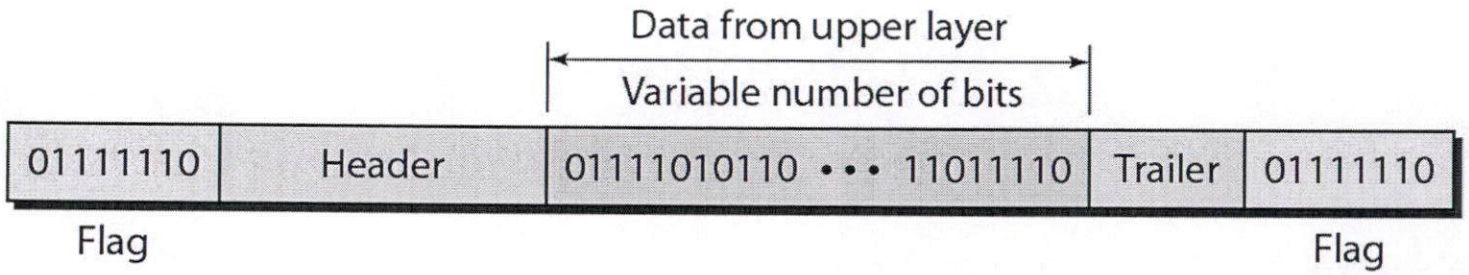
Data Link Layer

- The 8-bit flag contains the pattern as 01111110.
- The pattern used for the flag could appear in the information.
- When the receiver encounters the flag pattern in the middle of the data, it thinks that it has reached the end of the frame.
- To overcome this problem a bit-stuffing strategy has been added to the bit-oriented framing.

Data Link Layer

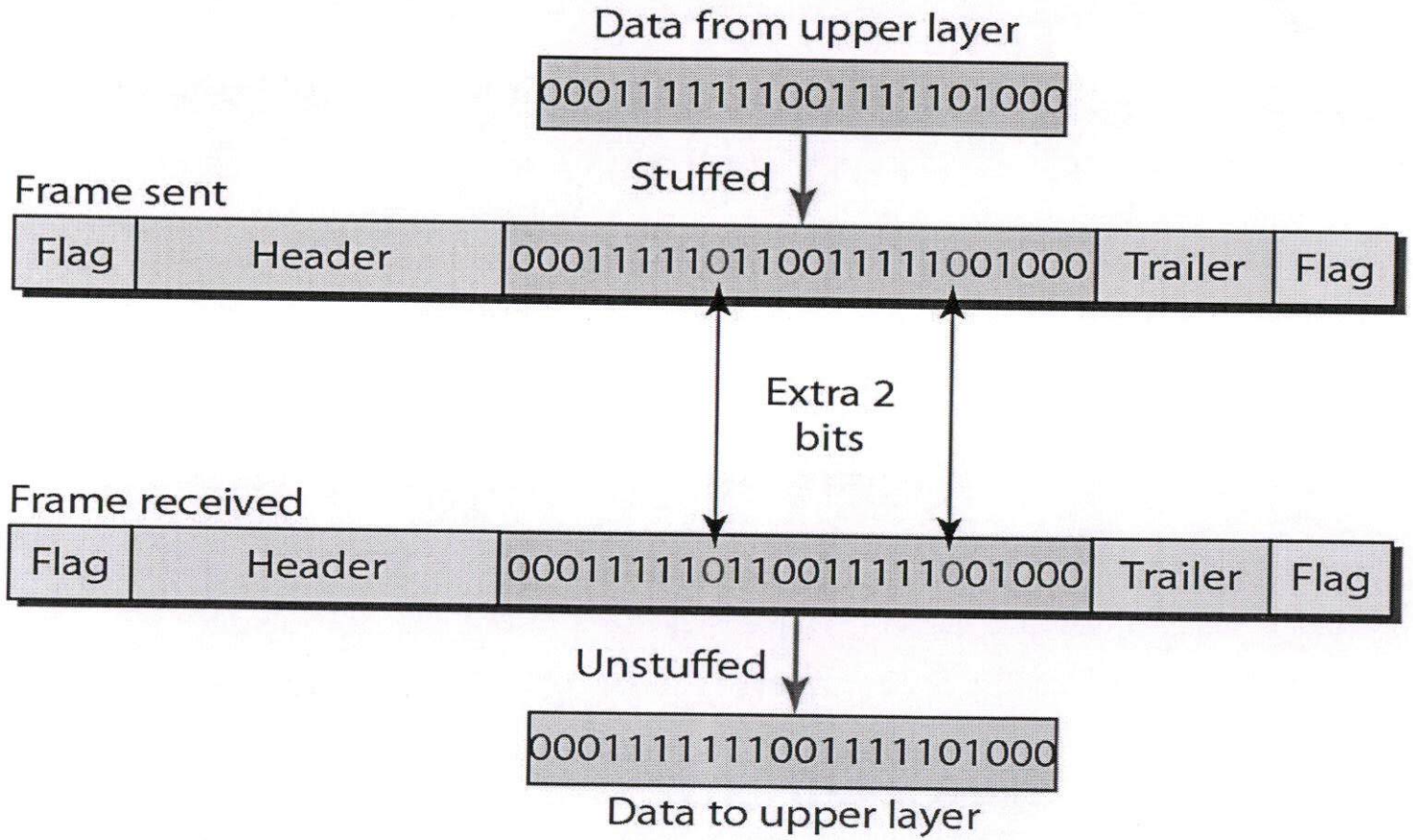
- Bit-Oriented Approach

- A frame in bit-oriented approach has been shown in below figure.



- In addition to header and trailer we need specific 8-bit pattern to separate one frame from another.

Data Link Layer

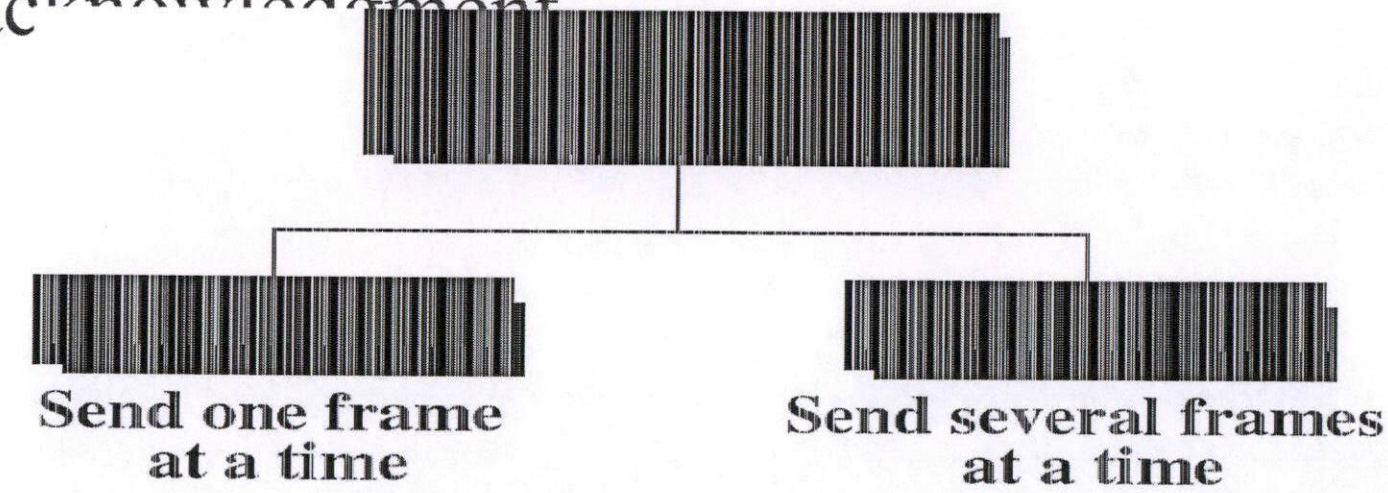


Data Link Layer

- Whenever the sender's data link layer encounters 0 followed by five consecutive 1s in the data, it automatically stuffs a 0 bit into the outgoing bit stream as shown in above figure.
- When ever the receiver encounters the extra 0 bits after five consecutive 1s in the data, it removes it from the data section and treats the next bit as data not as flag.

Data Link Layer

- Flow Control
  - Flow control refers to a set of procedures or methods used to restrict the amount of data that the sender can send before waiting for acknowledgment



Data Link Layer

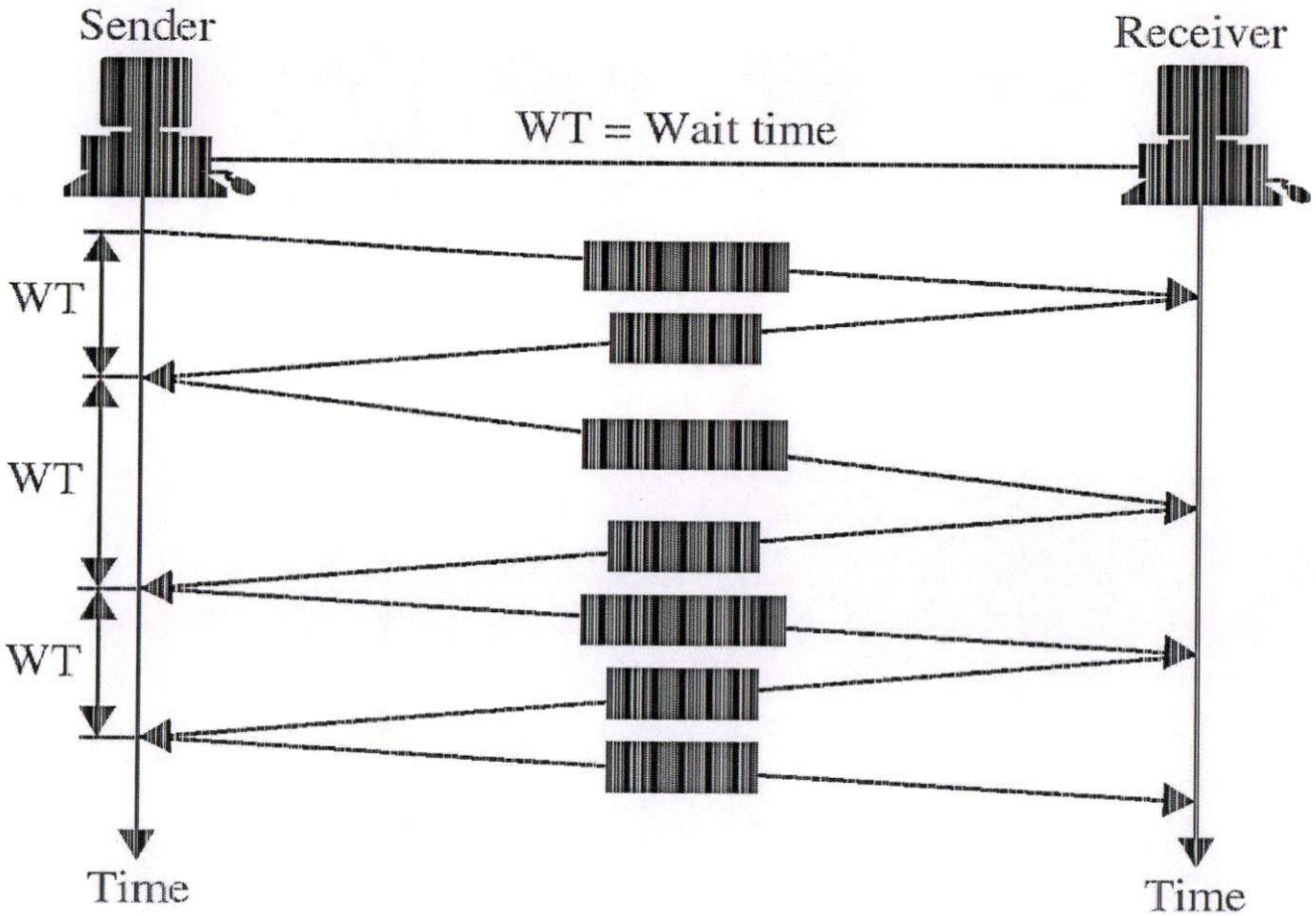
- Stop-and-Wait Protocol

- In a stop-and-wait method of flow control, the sender waits for an acknowledgement after every frame it sends.

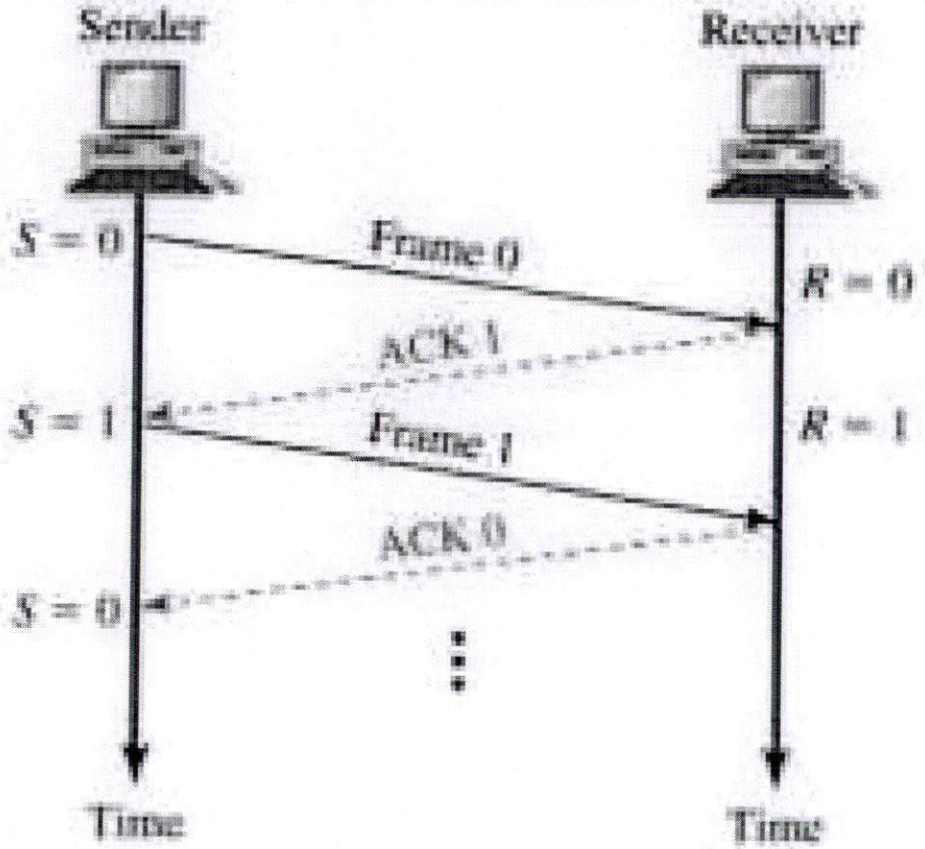
- Only when an acknowledgement has been received is the next frame sent.

- This process of alternately sending and waiting repeats until the sender transmits an end of transmission (EOT) frame

Data Link Layer



Data Link Layer



Unit-III

Congestion Control

COMPUTER NETWORKS

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Associate Professor/CSE

Congestion Control

- When too many packets are present in the subnet, performance degrades.
- This situation is called **congestion**.
- As traffic increases too far, the routers are no longer able to cope and they begin losing packets.
- At very high traffic, performance collapses completely and almost no packets are delivered.
- Congestion can be generated due to several factors.

Congestion Control

- If all of a sudden, streams of packets begin arriving on three or four input lines and all need the same output line, a queue will build up.
- If there is insufficient memory to hold all of them, packets will be lost.
- Adding more memory may help up to a point.
- If routers have an infinite amount of memory, congestion gets worse, not better.
- Because by the time packets get to the front of the queue, they have already timed out.

Congestion Control

- Slow processors can also cause congestion.
- If the routers' CPUs are slow at performing the processing task of the incoming packets queue will built up.
- Similarly, low-bandwidth lines can also cause congestion.
- The major cause of congestion is often the nature of the traffic.
- **Congestion control** refers to the mechanism and techniques used to control the congestion and keep the traffic below the capacity of the network.
- The congestion control techniques are broadly classified into two categories.

 Open Loop Congestion Control

 Closed Loop Congestion Control

Congestion Control

- Open Loop Congestion Control

- The protocols used to prevent or avoid congestion ensuring that the system will never enters into a congested state.

- Closed Loop Congestion Control

- The protocols that allows the system to enter the congested state, then detect it and remove it.

Congestion Control

- Choke Packets
  - It is a closed loop control technique.
  - Each router monitors its resources and utilization at each of its output lines.
  - There is a threshold set by the administrator.
  - Whenever any of the resource utilization crosses this threshold the output line enters into warning state.
  - If so the router sends a choke packet back to the source telling it to reduce the traffic.
  - The original packet is tagged so that it will not generate other choke packets by the intermediate routers.

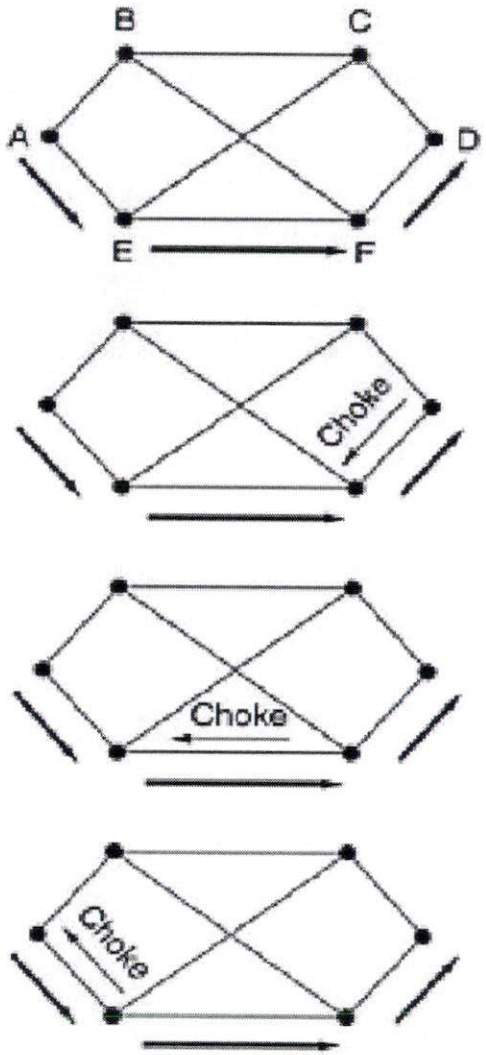
Congestion Control

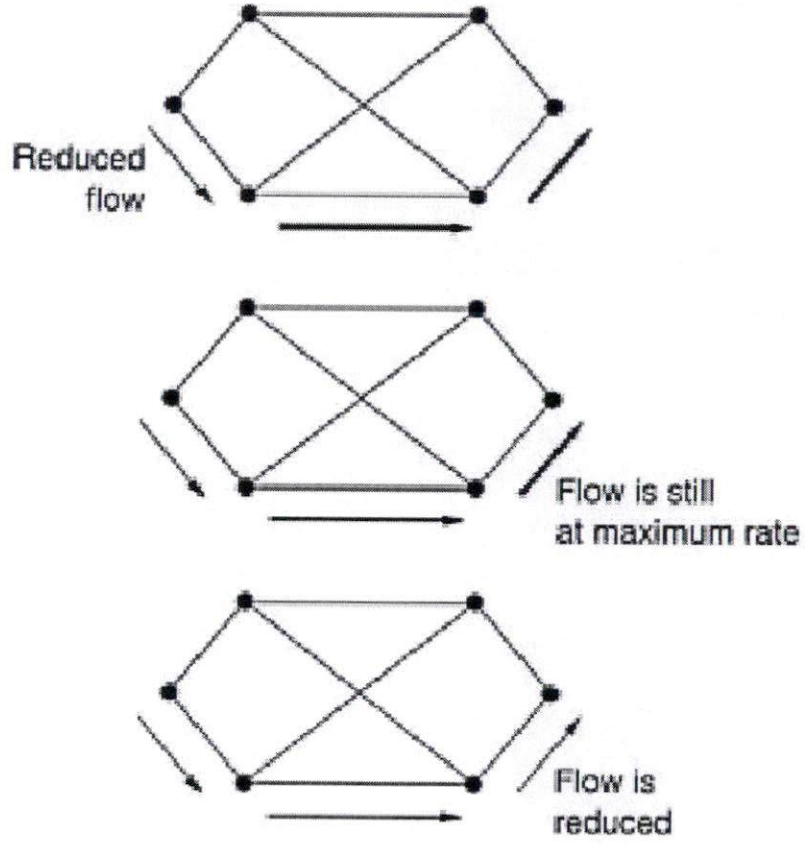
- When the source host gets the choke packet, it is required to reduce the traffic sent to the specified destination by X percent.
- Since other packets aimed at the same destination are probably already under way and will generate yet more choke packets.
- The host should ignore choke packets referring to that destination for a fixed time interval.
- After that period has expired, the host listens for more choke packets for another interval.

Congestion Control

- If any one choke packet arrives, the line is still congested.
- Therefore the host reduces the flow still more.
- If no choke packets arrive during the listening period, the host may increase the flow again.
- Several variations on this congestion control algorithm have been proposed.

Congestion Control





Unit-III

The Network Layer

Design Issues & Routing Algorithms

Unit-III

- Network Layer
- Design issues
- Routing algorithms
- Shortest path routing
- Flooding
- Hierarchical routing
- Broadcast
- Multicast
- Distance vector routing

Unit-III

- Congestion Control Algorithms
- Quality of Service
- Internetworking
- The Network layer in the internet

Network Layer Design Issues

- Store-and-Forward Packet Switching
- Services Provided to the Transport Layer
- Implementation of Connectionless Service
- Implementation of Connection-Oriented Service
- Comparison of Virtual-Circuit and Datagram Subnets

The Network Layer

- The network layer is concerned with getting packets from the source to the destination.
- It must also take care to select routes to avoid overloading some of the communication lines and routers while leaving others idle.

Network layer duties

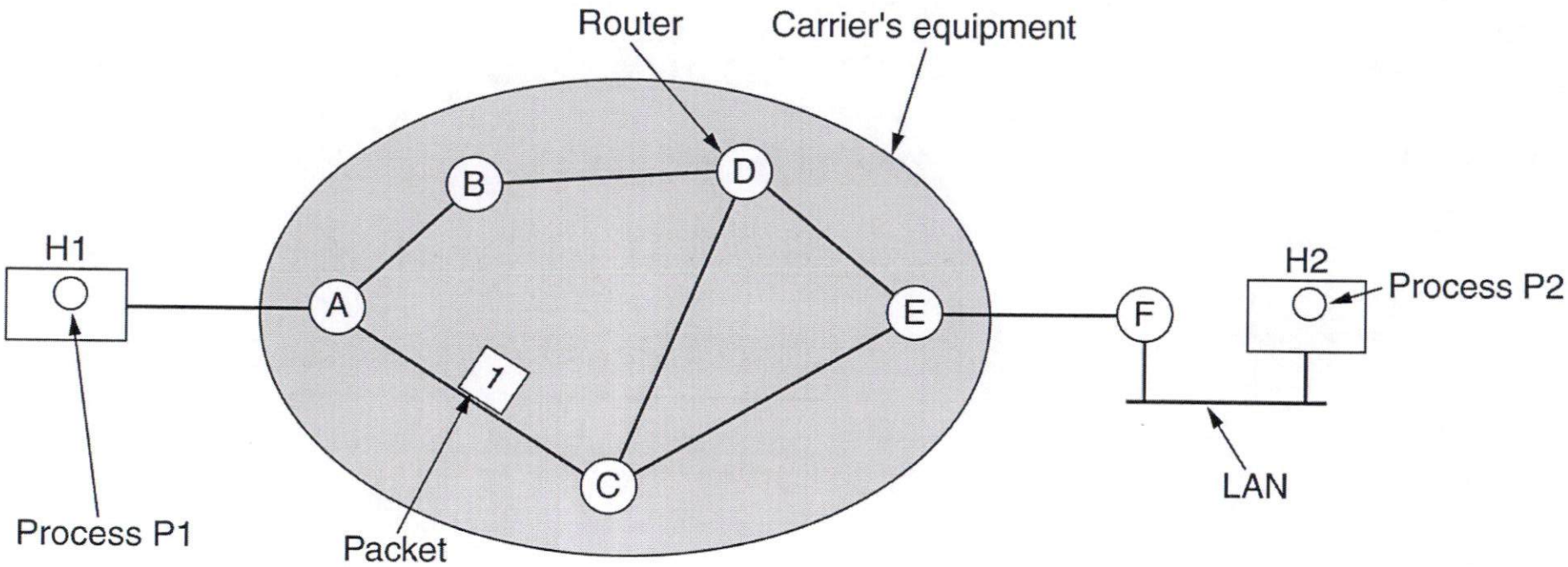
- Internetworking.
- Addressing.
- Routing.
- Packetizing.
- Fragmenting.

Network Layer Design Issues

Store-and-Forward Packet Switching

- A host with a packet to send, transmits it to the nearest router, either on its own LAN or over a point-to-point link to the carrier.
- The packet is stored there until it has fully arrived so the checksum can be verified.
- Then it is forwarded to the next router along the path until it reaches the destination host, where it is delivered.

Store-and-Forward Packet Switching



The environment of the network layer protocols.

Network Layer Design Issues

- Services Provided to the Transport Layer

The network layer services have been designed with the following goals in mind.

- The services should be independent of the router technology.
- The transport layer should be shielded from the number, type, and topology of the routers present.
- The network addresses made available to the transport layer should use a uniform numbering plan, even across LANs and WANs.

Network Layer Design Issues

- Services offered
  - Connectionless service
    - Packets are injected into the subnet individually and routed independently of each other.
    - No advance setup is needed.
    - In this context, the packets are frequently called datagrams.

Transport Layer

Transport Services

Elements of Transport protocols

Connection management

TCP and UDP protocols

Transport Layer

- The transport layer is the fourth layer from the bottom in the OSI reference model.
- It is responsible for message delivery from process running in source computer to the process running in the destination computer.
- Transport layer does not perform any function in the intermediate nodes.
- It is active only in the end systems.

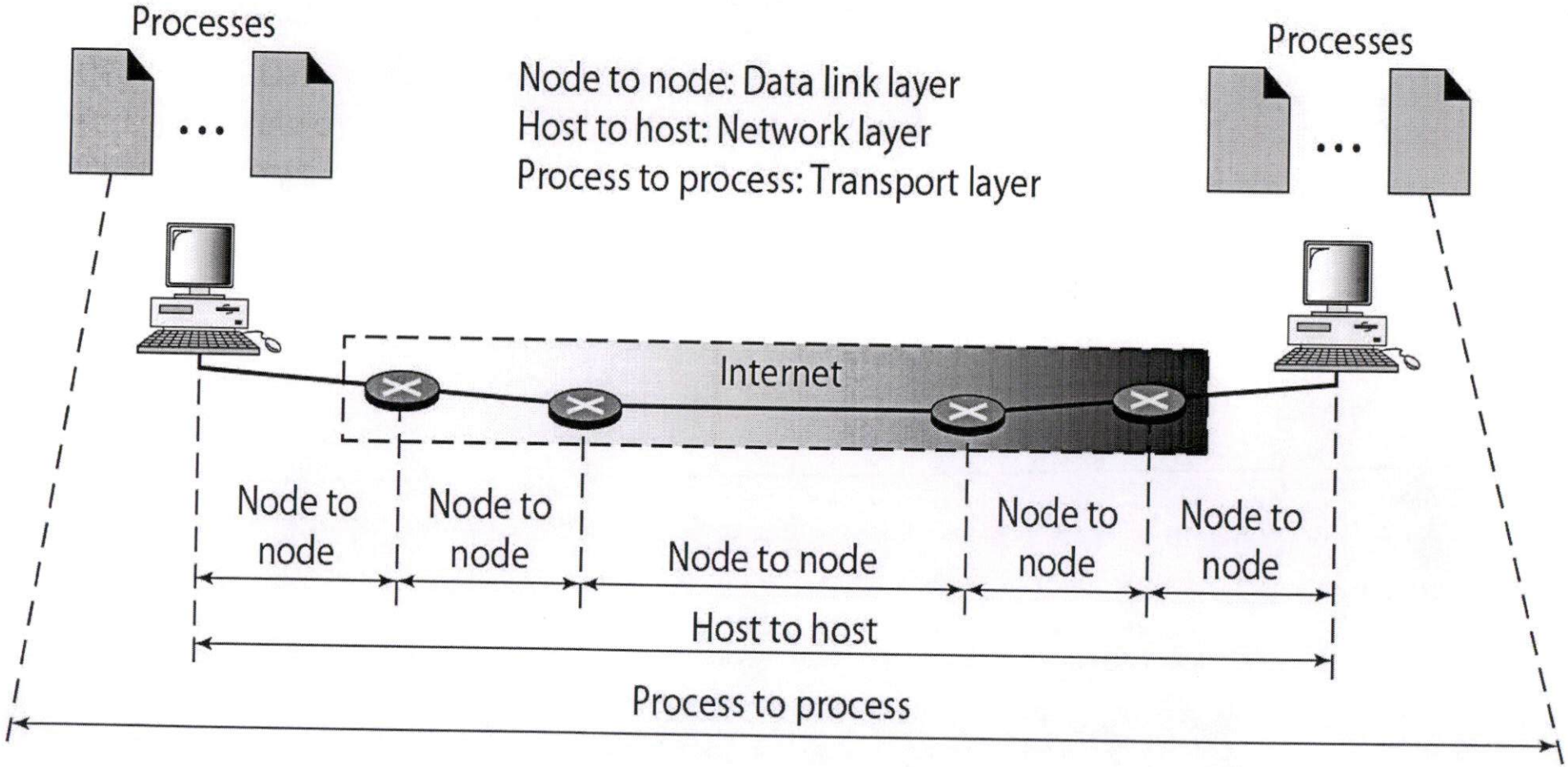
Transport Layer

- Data Link Layer is responsible for delivery of frames between two neighboring nodes over a link.
  - This is called ***node-to-node delivery.***
- Network Layer is responsible for delivery of datagrams between two hosts.
  - This is called ***host-to-host delivery.***
- Transport Layer is responsible for delivery of entire message from one process running on source to another process running on destination.
  - This is called ***process-to process delivery.***

Transport Layer

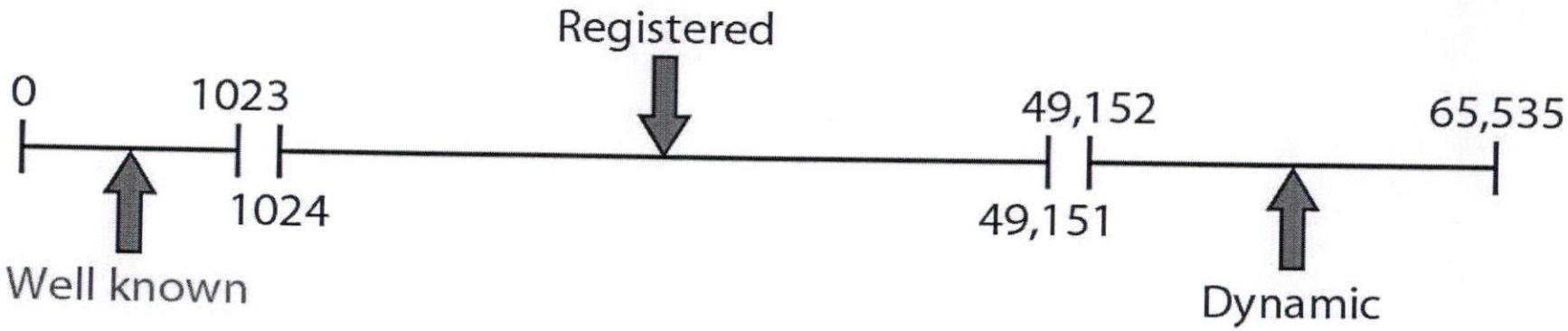
- **Establishing, Maintaining & Releasing Connection**
  - The transport layer establishes, maintains & releases end-to-end transport connection on the request of upper layers.
  - Establishing a connection involves allocation of buffers for storing user data, synchronizing the sequence numbers of packets etc.
  - A connection is released at the request of upper layer.

Transport Layer



Transport Layer

- The IANA (Internet Assigned Number Authority) has divided the port numbers into three categories.



Transport Layer

- The transport layer delivers the message from one process to another process running on two different hosts.
- Thus, it has to perform number of functions to ensure the accurate delivery of message.
- The various functions of transport layer are:
  - Establishing, Maintaining & Releasing Connection
  - Addressing
  - Data Transfer
  - Flow Control
  - Error Control
  - Congestion Control

Transport Layer

- Well-known Ports
  - The ports ranging from 0 to 1023 are assigned and controlled by IANA.
  - Theses are called as well-known ports.
- Registered Ports
  - The ports ranging from 1024 to 49151 are not registered or controlled by IANA.
  - They can only be registered with IANA to prevent duplication.

Transport Layer

- Dynamic Ports
  - The ports ranging from 49152 to 65535 are neither registered nor controlled.
  - They can be used by any process.
- Socket Address
  - Process to process delivery requires two identifiers at each end for making connection.
  - IP address and Port number
  - The combination of IP address and Port number is called as Socket Address.

Application Layer

Domain Name System

SNMP

Electronic Mail

The World Wide WEB

HTTP

Streaming audio and video

Application Layer

- Domain Name Space (DNS)

- Name Space
  - It is a technique that maps each address to a unique name.
  - Name Space can be of two types.
    - Flat Name Space
    - Hierarchical Name Space

Application Layer

- Flat Name Space
- In a flat name space, a name is assigned to an address.
- A name in this space is a sequence of characters without structure.
- The names may or may not have a common section.
- The main disadvantage of a flat name space is that it cannot be used in a large system such as the Internet.
- Because it must be centrally controlled to avoid ambiguity and duplication.

Application Layer

Hierarchical Name Space

- In a hierarchical name space, each name is made of several parts.
- The first part can define the nature of the organization, the second part can define the name of an organization, the third part can define departments in the organization, and so on.
- In this case, the authority to assign and control the name spaces can be decentralized.
- A central authority can assign the part of the name that defines the nature of the organization and the name of the organization.

Application Layer

- The responsibility of the rest of the name can be given to the organization itself.
- The organization can add suffixes (or prefixes) to the name to define its host or resources.
- The management of the organization need not worry that the prefix chosen for a host is taken by another organization because, even if part of an address is the same, the whole address is different.

Application Layer

- For example, assume two colleges and a company call one of their computers *challenger.*
- The first college is given a name by the central authority such as *jhda.edu,* the second college is given the name *berkeley.edu,* and the company is given the name *smart. com.*
- When these organizations add the name *challenger* to the name they have already been given, the end result is three distinguishable names:
- *challenger.jhda.edu*
- *challenger.berkeley.edu*
- *challenger.smart.com*

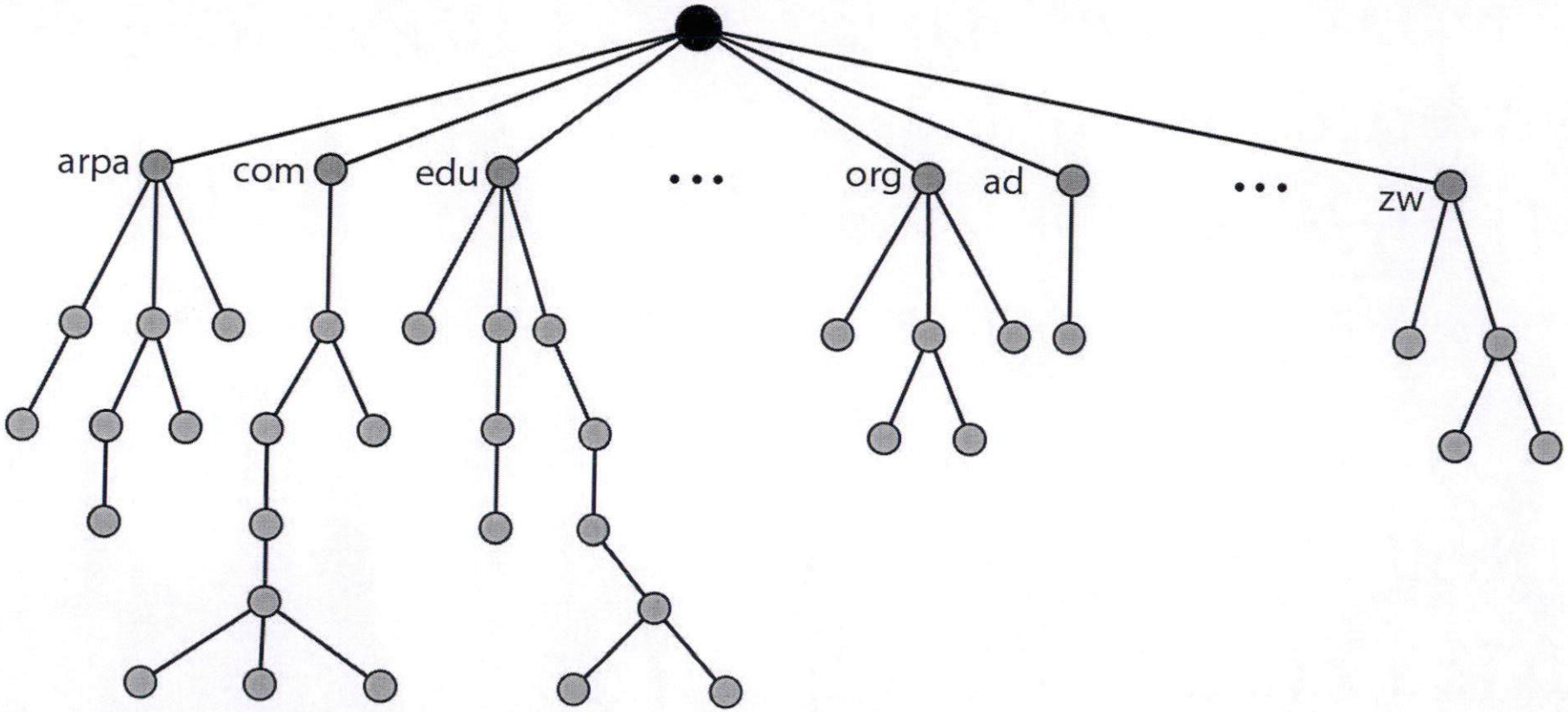
Application Layer

- Domain Name Space

- For creation of hierarchical name space the DNS was designed.
- In this design names are defined using an inverted tree structure.
- The tree can have 128 levels.
- Label
- Each node in the tree has been assigned a label.
- It is a string with maximum 63 characters.

Application Layer

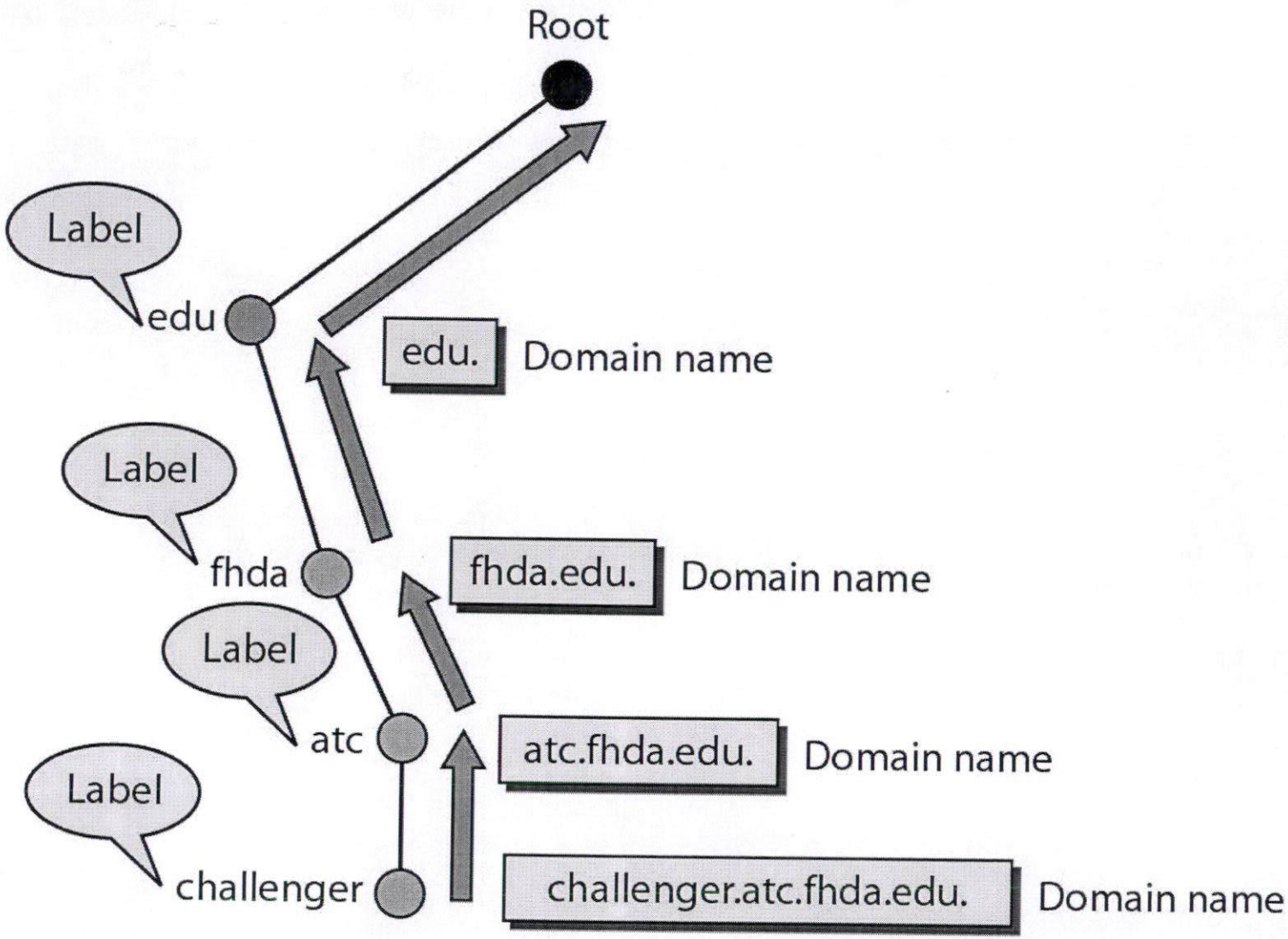
- The label for the root is null.
- To provide uniqueness to the domain names the children of a node have different labels.



Application Layer

- Domain Name
- A full domain name is a sequence of labels separated by dots (.).
- The domain names are always read from leaf node upto the root.
- The full domain name always ends with a null label.

Application Layer



H.T No: | | | | | | | | | | | **R18** Course Code: A30514

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

B.Tech V Semester Supplementary Examinations June/July-2022

Course Name: COMPUTER NETWORKS

(Common for CSE & IT)

Date: 01.07.2022 AN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. Draw a hybrid topology with a ring backbone and two bus networks. 2 M
2. Summarize about ISDN. 2 M
3. Explain the significance of error detection and error correction mechanisms in data link layer. 2 M
4. Identify the hamming distance for d(10001001, 10110001) 2 M
5. Define tunneling. 2 M
6. Explain about IPV4. 2 M
7. Draw and Label the format of UDP header. 2 M
8. Summarize about IGMP. 2 M
9. Identify the significance of URL. 2 M
10. Outline the significance of DNS? 2 M

PART-B

Answer the following.Each question carries TEN Marks. **5x10=50M**

11.A). i) Categorize the duties of top three layers in OSI model. 5M

ii) Differentiate and explain ISO-OSI reference model with TCP/IP. 5M

OR

11. B). Differentiate between circuit switched networks and virtual circuit networks. Elaborate with its diagrammatic representation. 10M

12. A). i) Describe how flow and error control takes place in networks with examples. 5M

ii) Summarize Ethernet IEEE 802.3 with its features, format, and characteristics. 5M

OR

12. B). i) List and explain the design issues of Data Link Layer. 5M

ii) Where do we use IEEE 802.11 standard? Explain its frame structure. 5M

13. A). Explain the following Routing protocols with Neat Diagrams. 10M

i) Distance Vector Routing

ii) Path Vector Routing

OR

13. B). What is a congestion? List and explain various congestion control mechanism. 10M

(P.T.O..)

14. A). i) Why do we require process-to-process delivery? Explain the role of process-to-process communication using ports. Give examples. 6M

ii) Describe QoS 4M

OR

14. B). i) Draw the TCP header and write brief explanation about each field in TCP header. 5M

ii) Explain about Token bucket algorithm to avoid the congestion in transport layer. 5M

15. A). Explain about SMTP and SNMP. 10M

OR

15. B). i) Discuss the features of HTTP and discuss how HTTP works. 5M

ii) What is Electronic mail? Explain the process of sending and receiving mails. 5M

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H.T No: | | | | | | | | | | | **R18** **Course Code: A30514**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Regular & Supplementary Examinations March -2021

Course Name: COMPUTER NETWORKS

(Computer Science & Engineering)

Date: 02.03.2021 FN **Time: 3 hours** **Max.Marks:70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. What is ARPANET? 2 M
2. What are the different layers in TCP/IP Protocol Suite? 2 M
3. Calculate the Humming Distance between 1111 and 0101 2 M
4. Describe the collision free protocols. 2 M
5. Explain how the gateway is different from router? 2 M
6. Write the difference between Connection Oriented and Connection Less Services 2 M
7. Write about the process to process delivery of a transport layer 2 M
8. Compare TCP and UDP 2 M
9. Identify the functionalities of an application layer. 2 M
10. Write a note on WWW? 2 M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

11. A). i). Explain Interfaces & Services of ISO-OSI reference model. 5 M
ii). Bring out the difference between OSI & TCP/IP model. 5 M

OR

11. B). Discuss about Guided and Unguided transmission media in detail. 10 M

12. A). What is the need for error detection? Explain the methods used for error detection and error correction? 10 M

OR

12. B). i). Compare various sliding window protocols of data link layer. 5 M
ii). What is slotted ALOHA? Mention its advantages and disadvantages? 5 M

13. A). Design algorithm using Disjktras algorithm to list all nodes on the cheapest path to a given destination 10 M

OR

13. B). List various congestion control solutions. Explain any one in detail. 10 M

14. A). Illustrate the Connection Establishment and Connection Termination using Three-Way Handshaking in TCP. 10 M

OR

14. B). Demonstrate transport services and elements of transport protocols. 10 M

(P.T.O..)

15. A). i). Do you agree SMTP allows Electronic Mail, Justify? 5 M

ii). Discuss about Domain Name Server. 5 M

OR

15. B). Explain streaming audio and video traffic at application layer. 10 M

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H.T No: | | | | | | | | | | | **R18** **Course Code: A30514**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

B.Tech V Semester Regular Examinations January -2022

Course Name: COMPUTER NETWORKS

(Common to CSE & IT)

Date: 04.01.2022 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries TWO marks. **10x2=20M**

1. Recall the role played by a protocol in communication. 2 M
2. List the advantages of optical fiber. 2 M
3. Define piggybacking technique and its advantages. 2 M
4. Outline the issues related to Dynamic Channel Allocation. 2 M
5. List the four parameters that define Quality of service. 2 M
6. Contrast adaptive and non-adaptive routing algorithms. 2 M
7. Compare TCP and UDP. 2 M
8. List the transport layer service primitives. 2 M
9. List the components present in E-Mail architecture. 2 M
10. Name any four HTTP request methods. 2 M

PART-B

Answer the following.Each question carries TEN Marks. **5x10=50M**

11.A). Illustrate the functioning of ISO-OSI reference model highlighting the functionalities and protocols of the layers. 10 M

OR

11. B). Draw the Electromagnetic spectrum and list the different wireless transmissions possible with respect to the frequency ranges. 10 M

12. A). Compare error detection and error correction techniques. The message 101011000110 is protected by a CRC checksum that was generated with the polynomial x^6+x^4+x+1. The checksum is in the tail (the right side) of the message. (i) How many bits is the checksum? (ii) If no transmission errors occurred, what would the original data be? (iii) Were there any transmission errors? 10 M

OR

12. B). Draw the frame format of IEEE 802.11 standard and explain the functionality of the fields present in the format. 10 M

13. A). Illustrate the functioning of Distance Vector routing with an example subnet and demonstrate count to infinity problem. 10 M

OR

13. B). Analyze the techniques used by TCP protocol to handle congestion control. 10 M

(P.T.O..)

14. A). Illustrate how connection management is handled in transport layer. 10 M

OR

14. B). Explain about transport layer services. 10 M

15. A). Draw the structure of E-Mail and explain briefly about MIME standard. 10 M

OR

15. B). Summarize the role played by DNS in network communication. 10 M

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