Noida Institute of Engineering and Technology, Greater Noida

Transport Layer

Unit: 4

Computer Networks
ACSE0602

B.Tech 6th sem

Sanjay Kumar Nayak
CSE
Department

Curriculum

EVALUATION SCHEME
SEMESTER-VI

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	ACSE0601	Advanced Java Programming	3	0	0	30	20	50		100		150	3
2	ACSE0602	Computer Networks	3	1	0	30	20	50		100		150	4
3	ACSE0603	Software Engineering	3	0	0	30	20	50		100		150	3
4		Departmental Elective -III	3	0	0	30	20	50		100		150	3
5		Departmental Elective -IV	3	0	0	30	20	50		100		150	3
6		Open Elective-I	3	0	0	30	20	50		100		150	3
7	ACSE0651	Advanced Java Programming Lab	0	0	2				25		25	50	1
8	ACSE0652	Computer Networks Lab	0	0	2				25		25	50	1
9	ACSE0653	Software Engineering Lab	0	0	2				25		25	50	1
10	ACSE0659	Mini Project	0	0	2				50			50	1
11	ANC0602 / ANC0601	Essence of Indian Traditional Knowledge / Constitution of India, Law and Engineering	2	0	0	30	20	50		50		100	
12		MOOCs (For B.Tech. Hons. Degree)											
		GRAND TOTAL										**1100**	**23**

Syllabus

DETAILED SYLLABUS		3-0-0
Unit	**Topic**	**Proposed Lecture**
I	**Introductory Concepts**: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. **Physical Layer:** Network topology design, Types of connections, Transmission media, Signal transmission and encoding, Network performance and transmission impairments, Switching techniques and multiplexing.	08
II	**Link layer:** Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges (learning bridge and spanning tree algorithms).	08
III	**Network Layer:** Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6.	08
IV	**Transport Layer:** Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	08
V	**Application Layer:** Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – basic concepts.	08

Text books and References:

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communication", Pearson.
4. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
5. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
6. W. A. Shay, "Understanding Communications and Networks", Cengage Learning.
7. D. Comer, "Computer Networks and Internets", Pearson.

Course Objective

The objective of this course is to understand introduction of computer networks with suitable transmission media and different networking devices. Network protocols which are essential for the computer network are need to explain such as data link layer protocols and routing protocols.

A detail explanation of IP addressing , TCP/IP protocols and application layer protocols are covered in this course.

Course Outcome

Course Outcome

Cos	**Outcomes** **After Completion of the Course Student will be able to**
CO1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.
CO2	Apply channel allocation, framing, error and flow control techniques and describe the functions of Network Layer i.e. Logical addressing, subnetting & Routing Mechanism.
CO3	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism.
CO4	Explain the functions offered by session and presentation layer and their Implementation.
CO5	Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP,TELNET and VPN.

PSO's

Program Specific Outcomes	Course Outcome				
	CO1	CO2	CO3	CO4	C05
PSO1	2	2	2	2	2
PSO2	2	2	2	2	2
PSO3	2	2	2	3	2
AVERAGE	2	2	2	2.3	2

PO's

1.Engineering knowledge
2. Problem analysis
3. Design/development of solutions
4. Conduct investigations of complex problems
5. Modern tool usage
6. The engineer and society
7. Environment and sustainability
8. Ethics
9. Individual and team work
10. Communication
11. Project management and finance
12. Life-long learning

PSO's

On successful completion of graduation degree, The computer Science & Engineering graduates will be able to:

PSO1: identify, analyze real world problems and design their ethical solutions using artificial intelligence, robotics, virtual/augmented reality, data analytics, block chain technology, and cloud computing.

PSO2: design and develop the hardware sensor devices and related interfacing software systems for solving complex engineering problems.

PSO 3: understand inter-disciplinary computing techniques and to apply them in the design of advanced computing.

PSO 4: conduct investigation of complex problem with the help of technical, managerial, leadership qualities, and modern engineering tools provided by industry sponsored laboratories.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	3	2	2	2	3	2	2	2	3
CO4	2	2	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg.	2	2	2	2	2	2	2	2	2	2	2	2

*3= High *2= Medium *1=Low

PSO's

Program Specific Outcomes	Course Outcome				
	CO1	CO2	CO3	CO4	C05
PSO1	2	2	2	2	2
PSO2	2	2	2	2	2
PSO3	2	2	2	3	2
AVERAGE	2	2	2	2.3	2

Program Educational Objectives

PEO 1: To have an excellent scientific and engineering breadth so as to comprehend, analyze, design and provide sustainable solutions for real-life problems using state-of-the-art technologies.

PEO 2: To have a successful career in industries, to pursue higher studies or to support entrepreneurial endeavors and to face the global challenges.

PEO 3: To have an effective communication skills, professional attitude, ethical values and a desire to learn specific knowledge in emerging trends, technologies for research, innovation and product development and contribution to society.

PEO 4: To have life-long learning for up-skilling and re-skilling for successful professional career as engineer, scientist, entrepreneur and bureaucrat for betterment of society.

Result Analysis

COMPUTER ORGANIZATION & ARCHITECTURE (KCS603)	
Department wise Result of VI sem.	NA
Subject wise result	NA
Faculty wise result	NA

Prerequisite and Recap

- **Duties of network layer**
- **Understanding about router and its function**

In previous unit

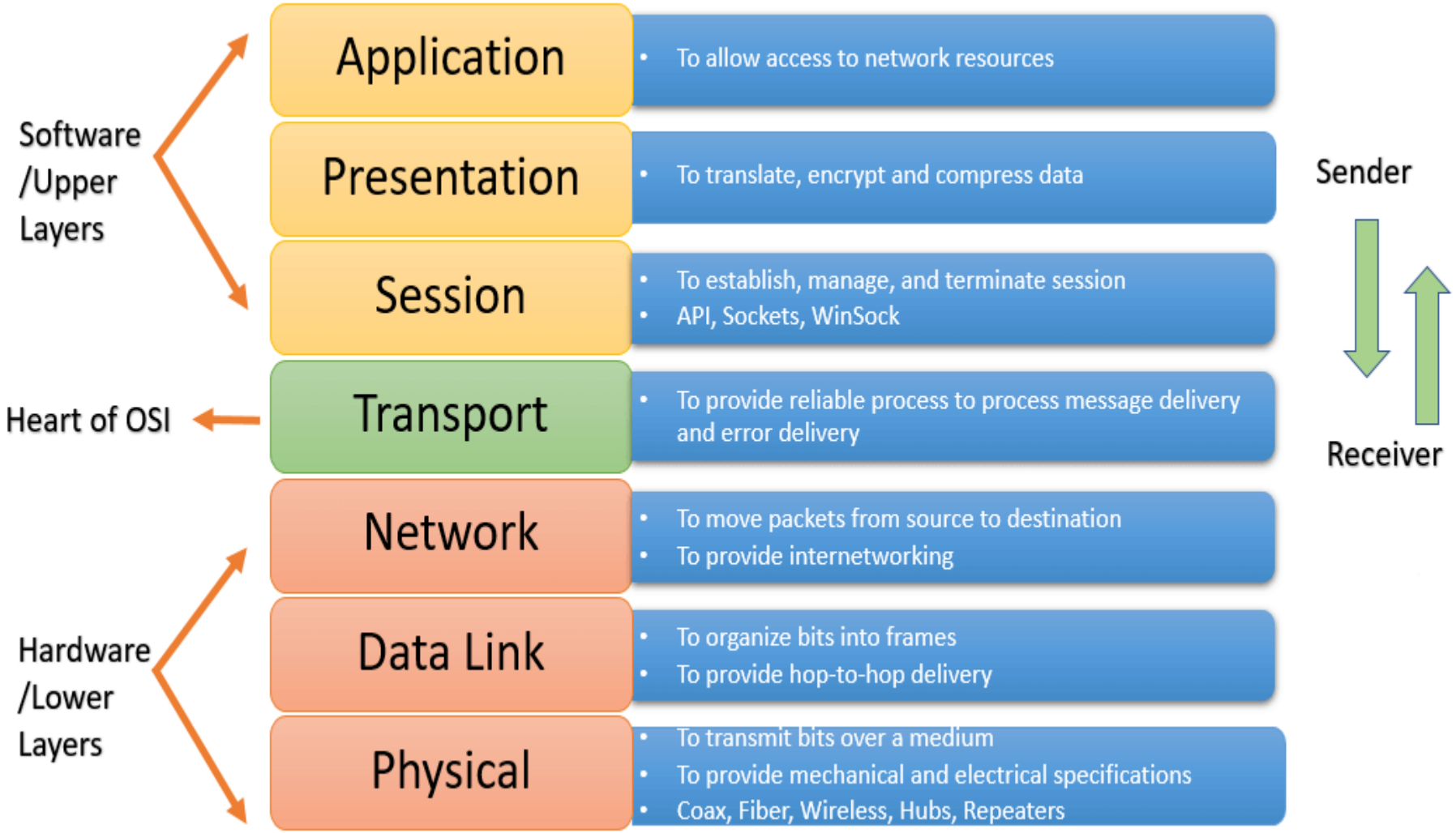
- Logical addressing
- IPv4 and IPv6
- Congestion control
- Routing protocols

Content

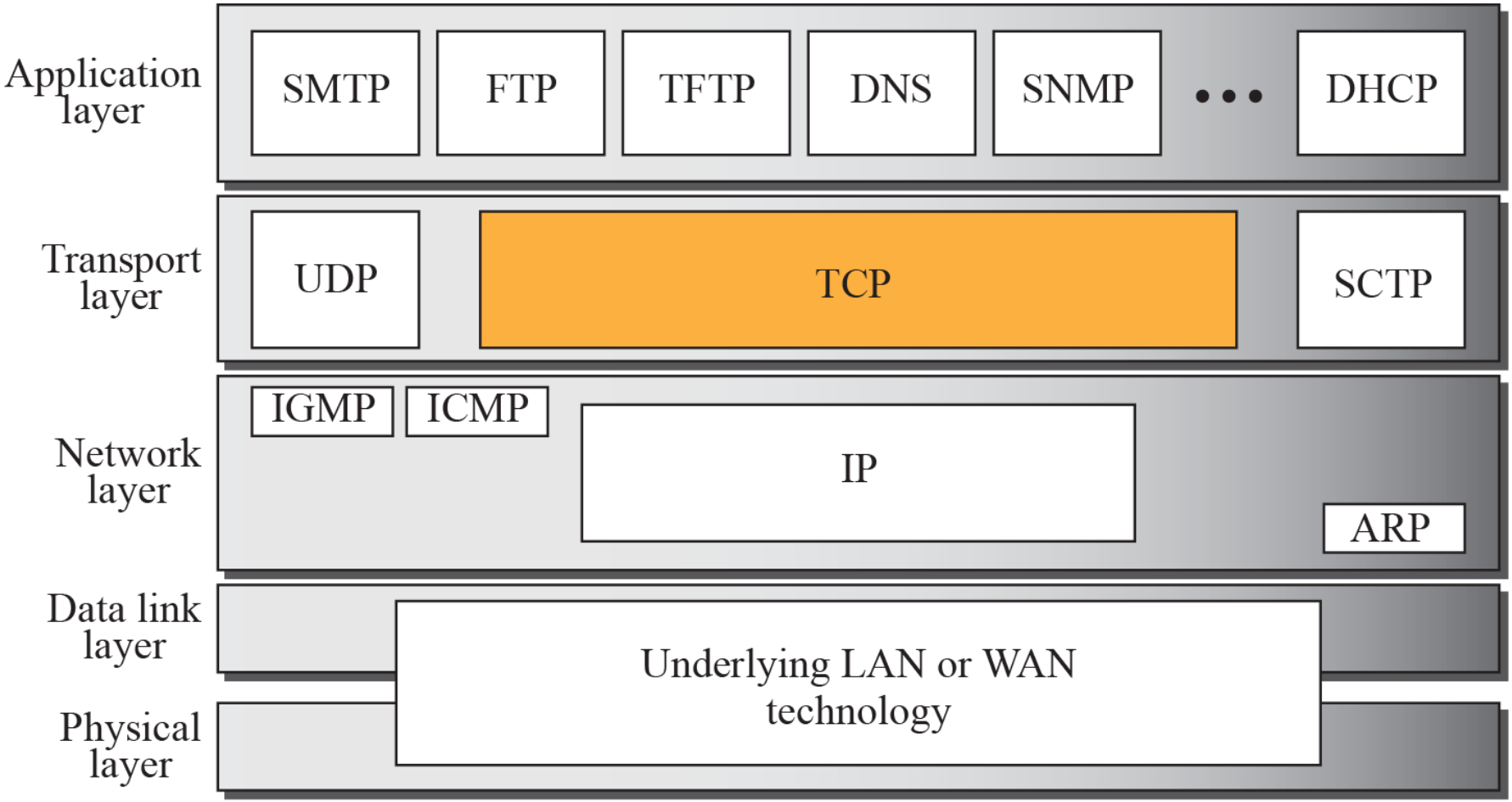
Unit 4

- Transport Layer: Process-to-process delivery
- Transport layer protocols (UDP and TCP)
- UDP header format
- TCP header Format
- Port addressing
- Multiplexing, Connection management
- Flow control and retransmission
- Window management
- TCP Congestion control
- Quality of service

OSI model


Application
To allow access to network resources
Presentation
To translate, encrypt and compress data
Session
To establish, manage, and terminate session
API, Sockets, WinSock
Transport
To provide reliable process to process message delivery and error delivery
Network
To move packets from source to destination
To provide internetworking
Data Link
To organize bits into frames
To provide hop-to-hop delivery
Physical
To transmit bits over a medium
To provide mechanical and electrical specifications
Coax, Fiber, Wireless, Hubs, Repeaters
Software /Upper Layers
Heart of OSI
Hardware /Lower Layers
Sender
Receiver

TCP/ IP model

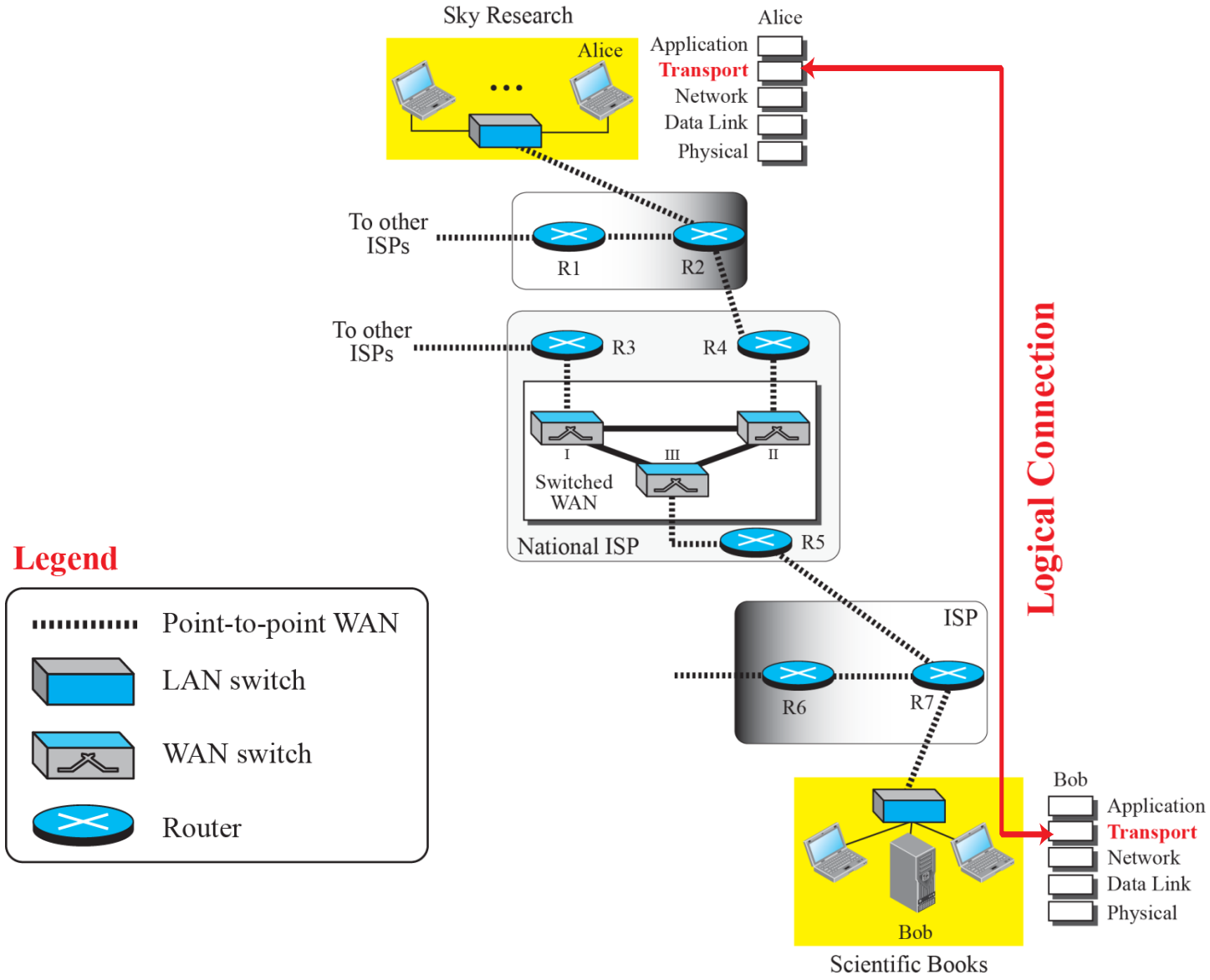

Application layer
SMTP
FTP
TFTP
DNS
SNMP
• • •
DHCP
Transport layer
UDP
TCP
SCTP
Network layer
IGMP
ICMP
IP
ARP
Data link layer
Underlying LAN or WAN technology
Physical layer

INTRODUCTION

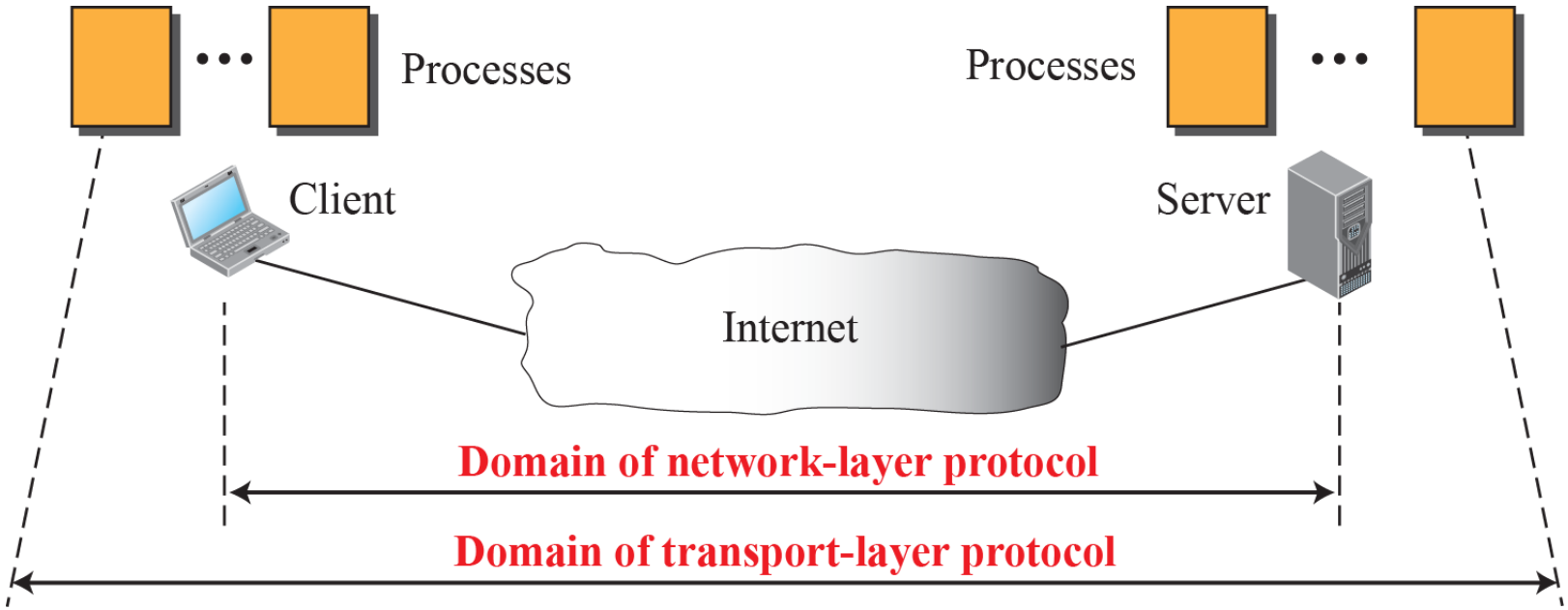
Objective: Study about basic concept of Transport layer and it functions

- The transport layer is located between the application layer and the network layer.
- It provides Process-to-process communication between two application layers, one at the local host and the other at the remote host.
- Communication is provided using a logical connection.

Logical connection at the transport layer



Network layer versus transport layer

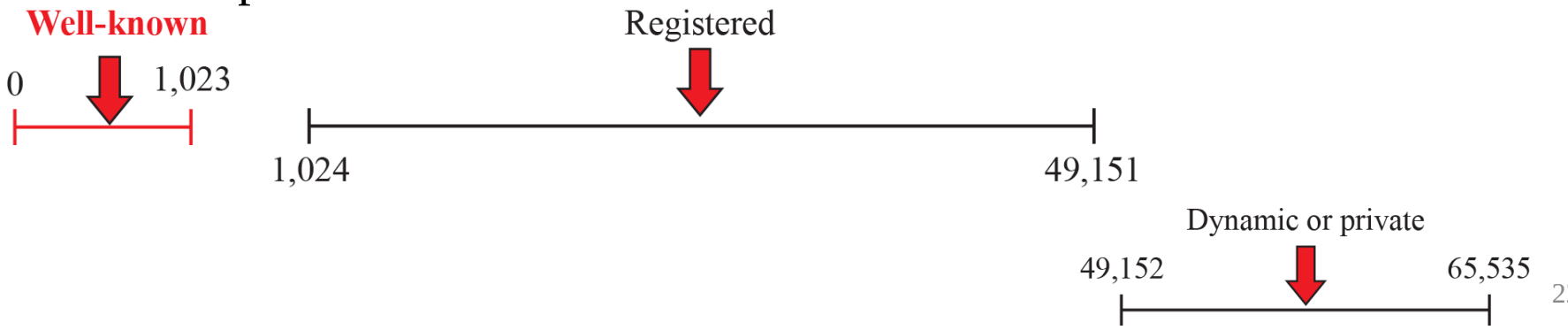


Functions of transport Layer

- Process to process delivery of data
- Port addressing
- Encapsulation and de capsulation
- Multiplexing and de multiplexing
- Connection less and connection oriented services
- Flow control and error control

Port numbers

- 16 bit integer number from 0 to 65535
- Well known port no. are fixed for particular application Provided by ICANN (Internet Corporation for Assigned Names and Numbers)
- eg. FTP -21, Telnet -23, DNS-53, TFTP-69 server uses the fix port number for particular application
- Client process knows the well known port no. for corresponding server process



Registered port numbers

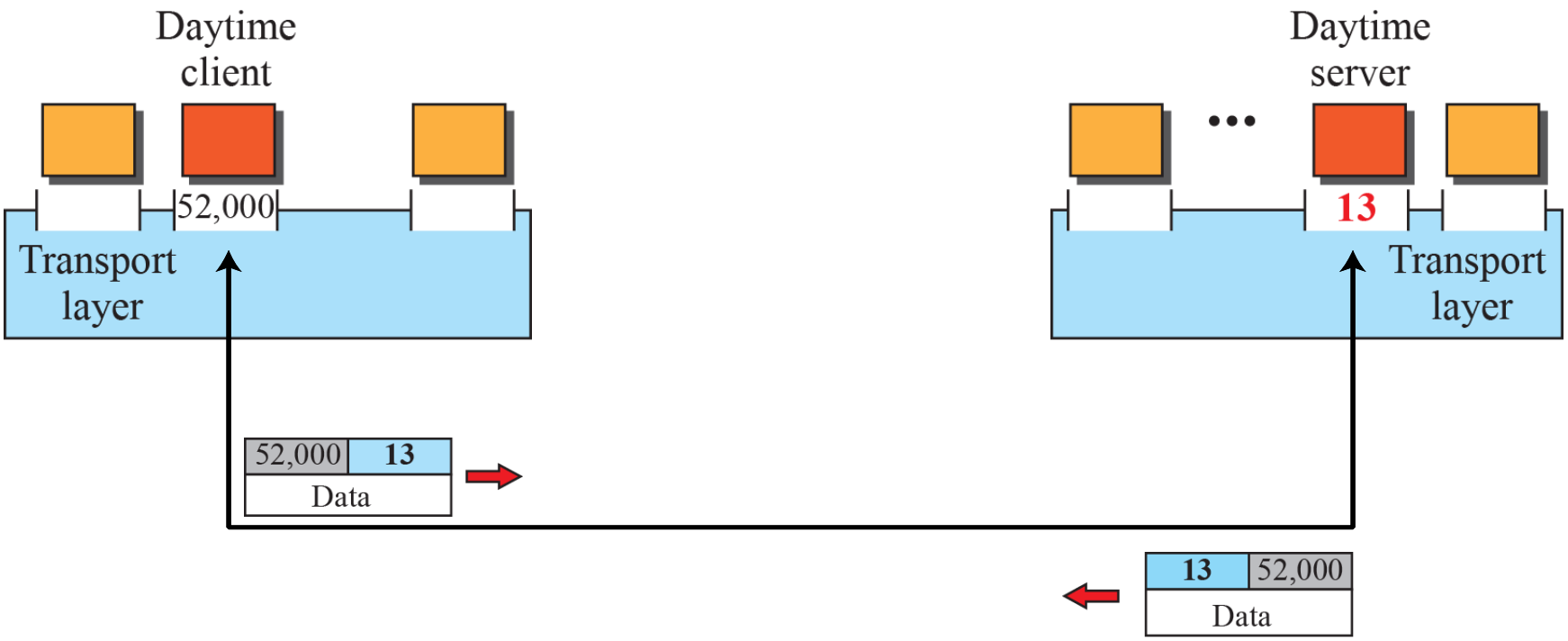
- 1024 to 49151
- Used by vendors for their own server applications

Dynamic port numbers

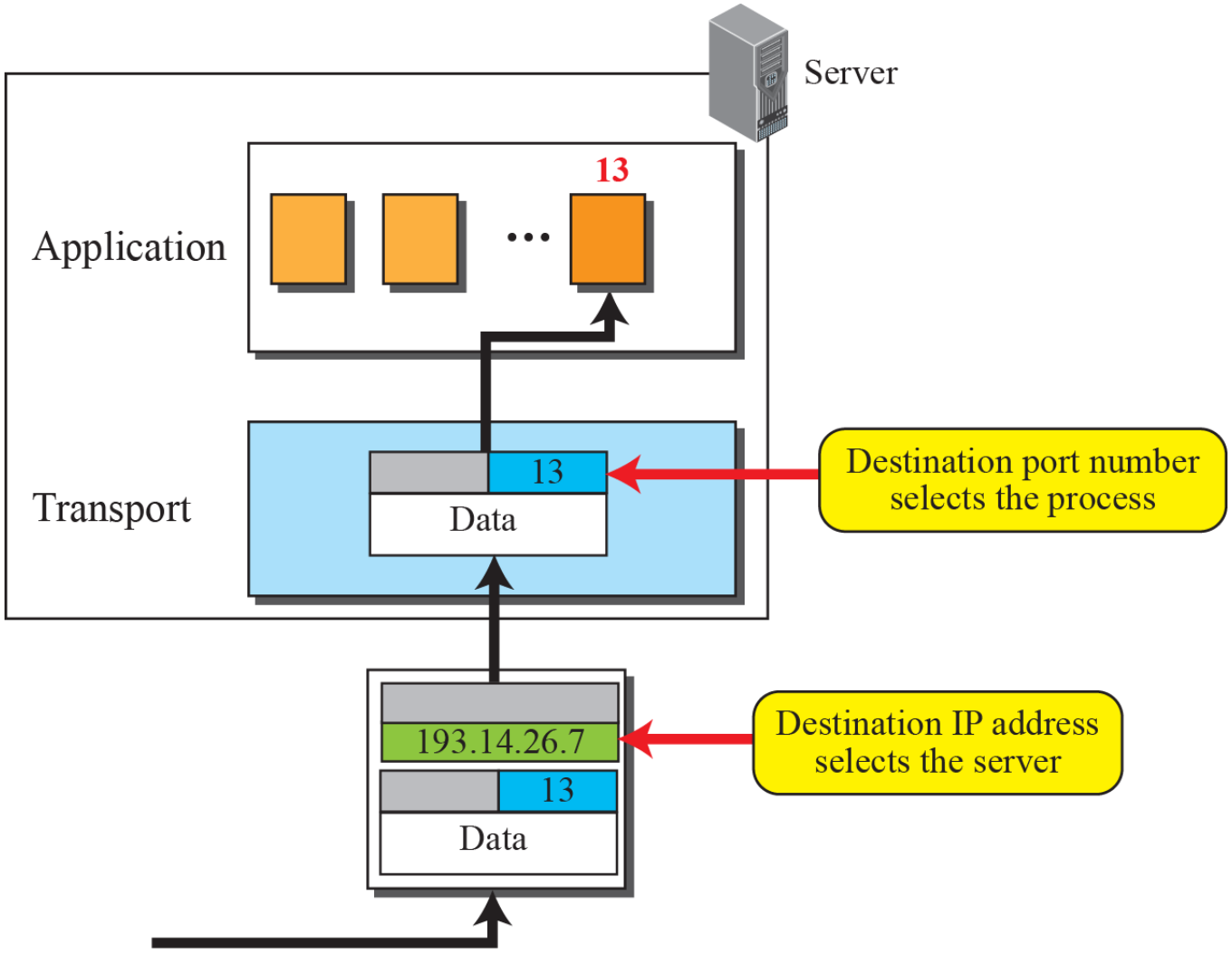
Ephemeral / Temporary port no.

- 49152 to 65535
- Client process define itself with port no. chosen randomly by transport layer

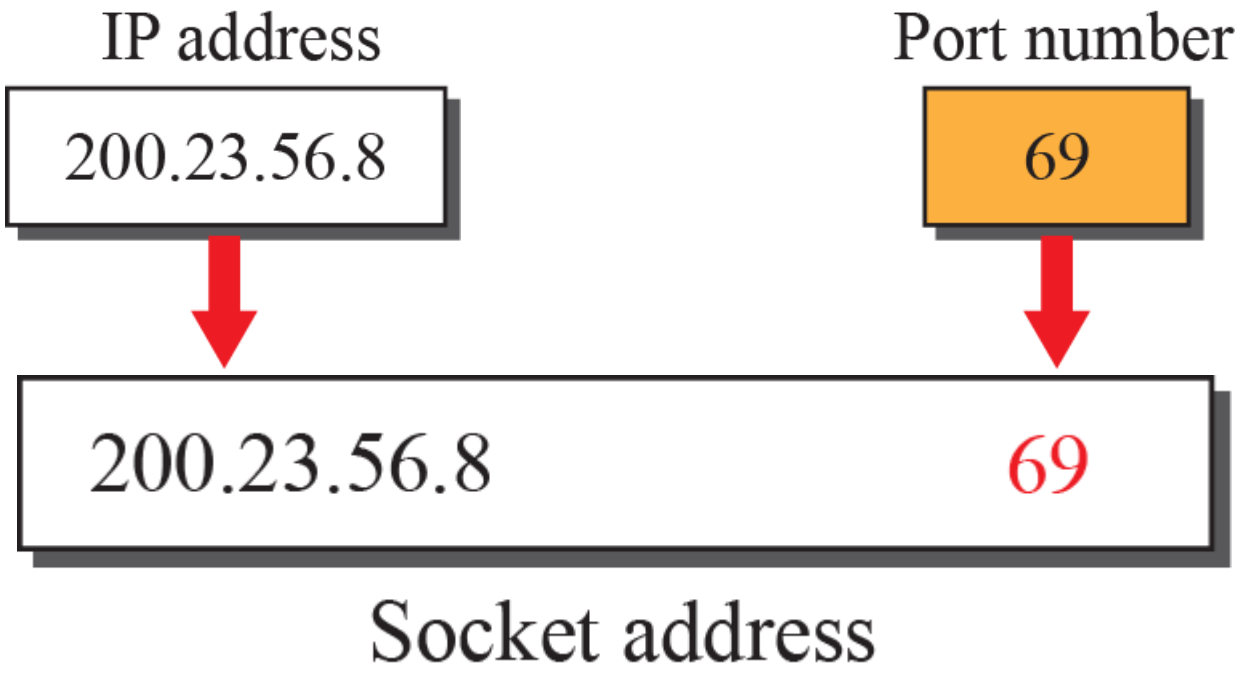
Example Port number



IP addresses versus port numbers



Socket address



Socket address

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.

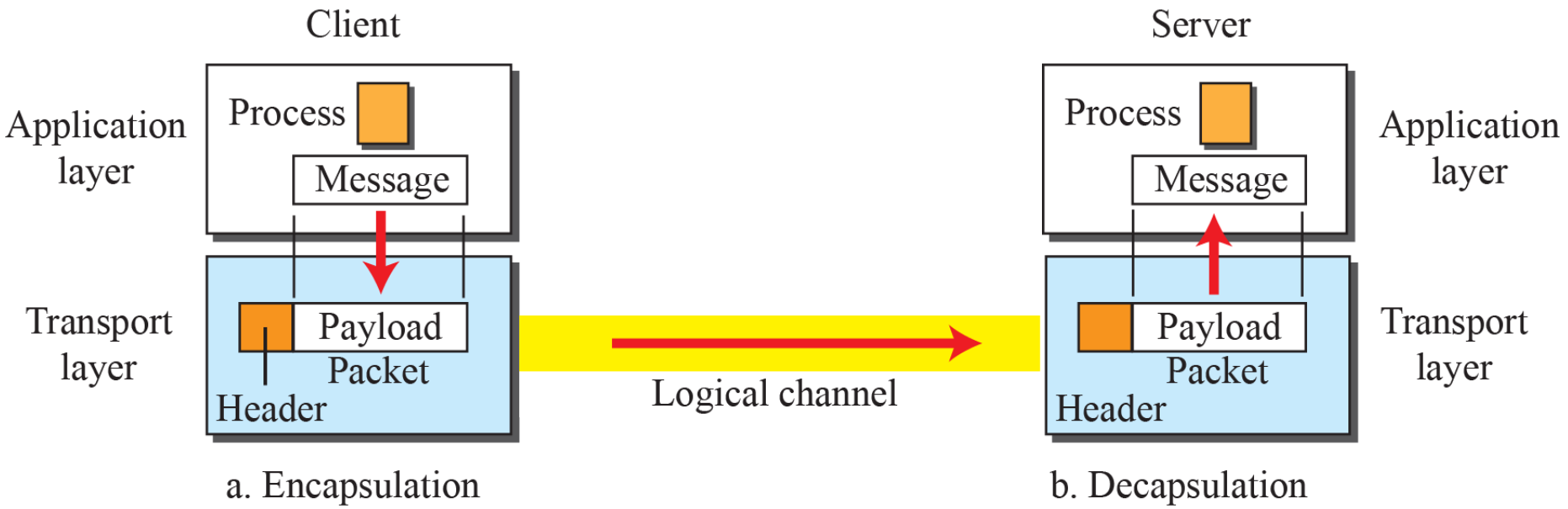
Types of Sockets : There are two types of Sockets: the **datagram** socket and the **stream** socket.

Socket address

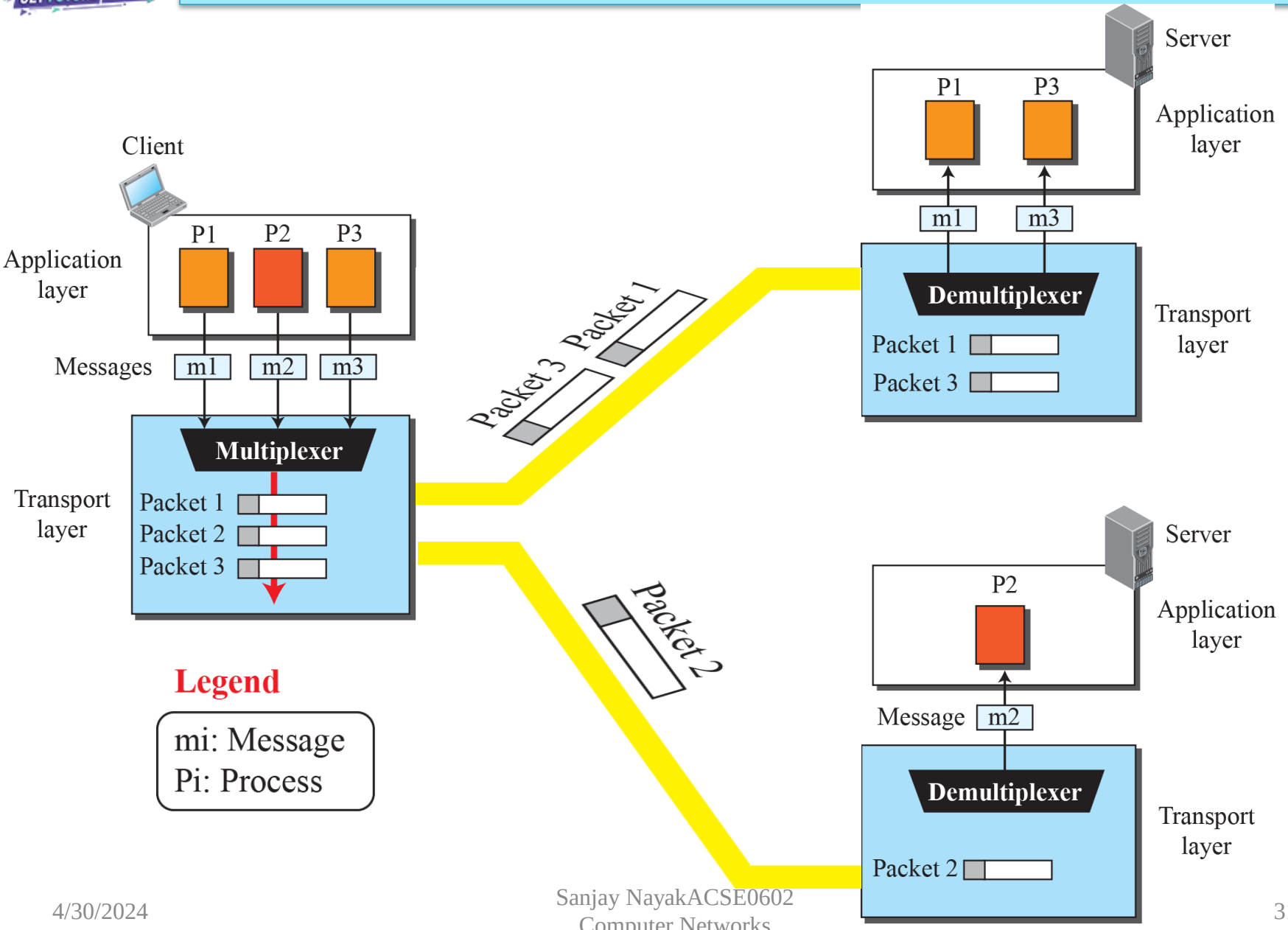
1.Datagram Socket : This is a type of network which has connection less point for sending and receiving packets. It is similar to mailbox. The letters (data) posted into the box are collected and delivered (transmitted) to a letterbox (receiving socket).

2.Stream Socket In Computer operating system, a stream socket is type of interprocess communications socket or network socket which provides a connection-oriented, sequenced, and unique flow of data without record boundaries with well defined mechanisms for creating and destroying connections and for detecting errors. It is similar to phone. A connection is established between the phones (two ends) and a conversation (transfer of data) takes place.

Encapsulation and de capsulation



Multiplexing and de multiplexing



TRANSPORT-LAYER PROTOCOLS

Objective: Study about basic concept of Transport layer protocols-UDP & TCP

- Transport-layer protocol are created by combining a set of services provided by transport –layer

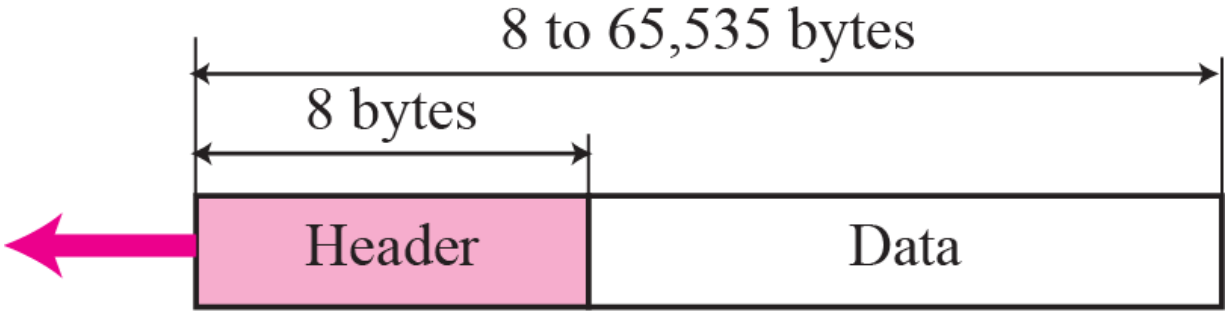
- Transport-layer protocol are

1. TCP –Transmission control protocol
   (connection oriented protocol)
2. UDP - User datagram protocol
   (connectionless protocol)

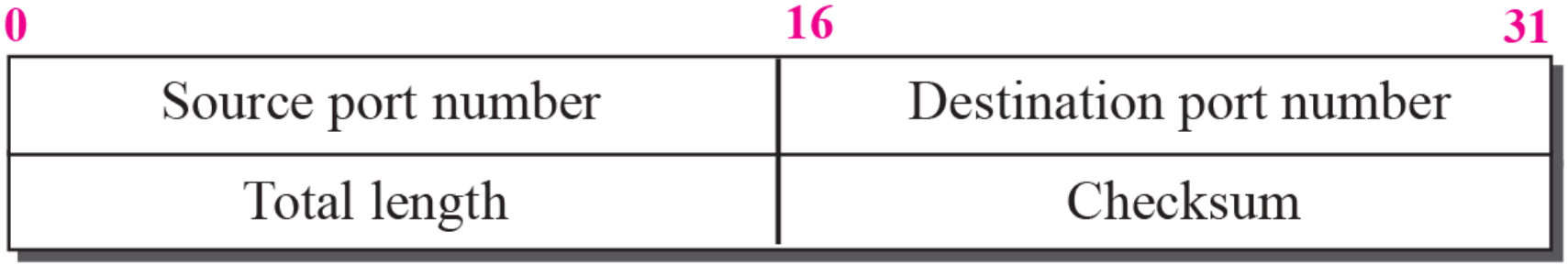
UDP -User datagram protocol

- Simple connectionless protocol
- Neither flow nor error control
- Receiver can immediately handle any packet it receives
- Receiver can never be overwhelmed with incoming packets.
- UDP packets, called user data grams, have a fixed-size header of 8 bytes.

UDP -User datagram protocol

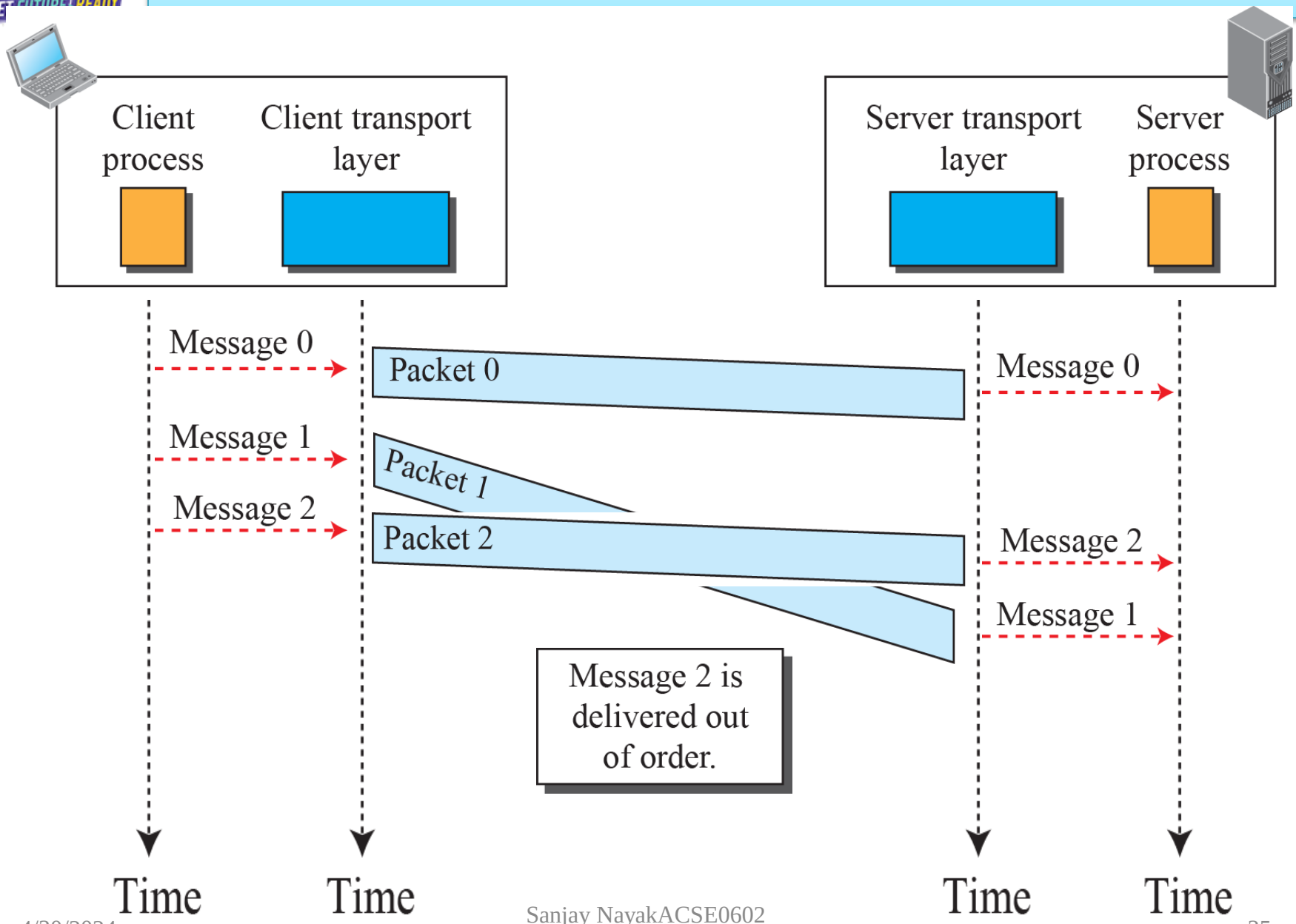


a. UDP user datagram



b. Header format

Connectionless service



Question

The following is a dump of a UDP header in hexadecimal format.

CB84000D001C001C

a. What is the source port number?
b. What is the destination port number?
c. What is the total length of the user datagram?
d. What is the length of the data?
e. Is the packet directed from a client to a server or vice versa?

Question

Solution

a. The source port number is the first four hexadecimal digits $(CB84)_{16}$ or 52100.

b. The destination port number is the second four hexadecimal digits $(000D)_{16}$ or 13.

c. The third four hexadecimal digits $(001C)_{16}$ define the length of the whole UDP packet as 28 bytes.

d. The length of the data is the length of the whole packet minus the length of the header, or 28 – 8 = 20 bytes.

e. Since the destination port number is 13 (well-known port), the packet is from the client to the server.

Question

the decimal equivalent of CB84 is

4*1=4

8*16=128

11*16*16=2816

12*16*16*16=49152

4+128+2816+49152=52100

Well known ports

Well-known Ports used with UDP

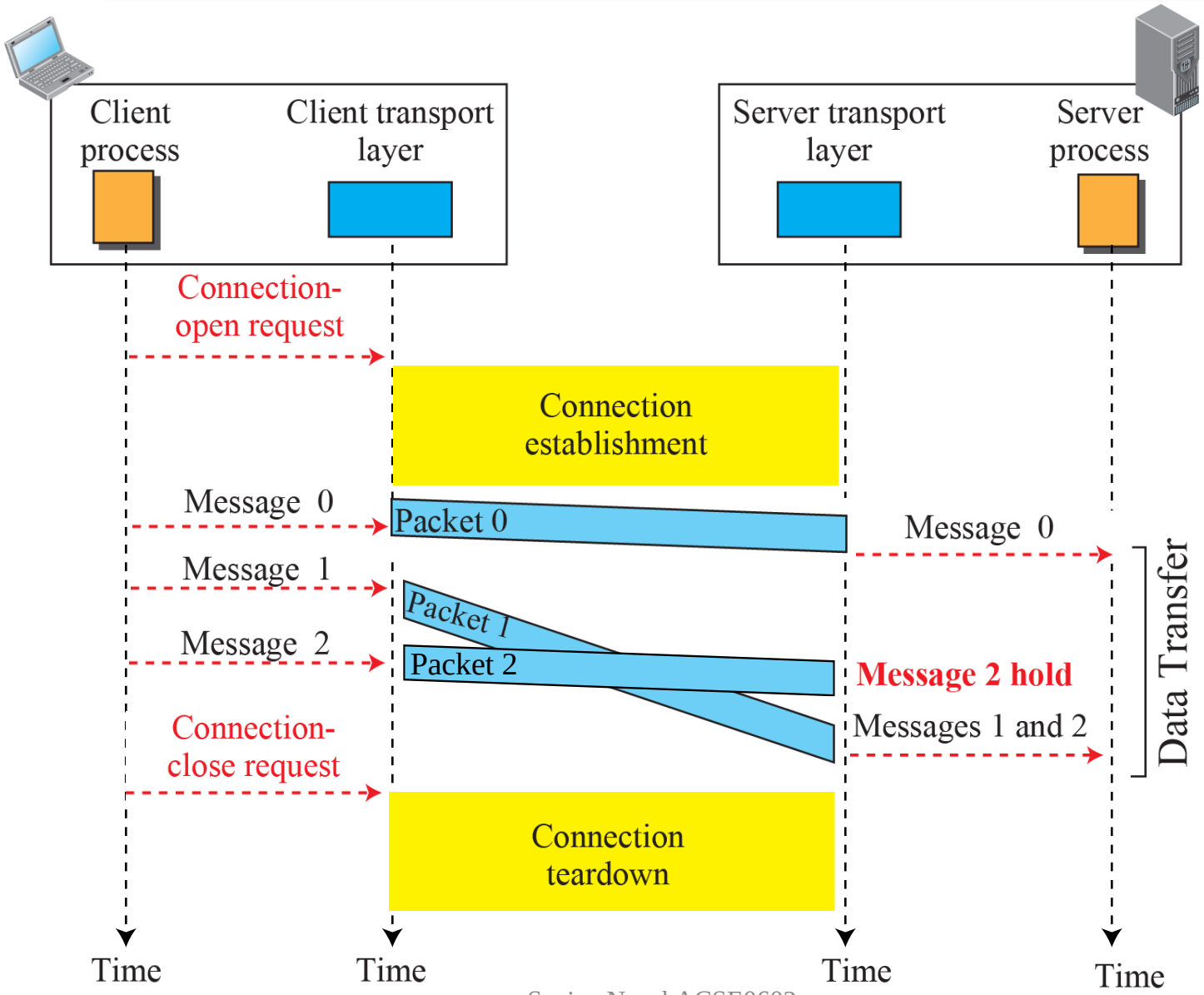
Port	*Protocol*	*Description*
7	Echo	Echoes a received datagram back to the sender
9	Discard	Discards any datagram that is received
11	Users	Active users
13	Daytime	Returns the date and the time
17	Quote	Returns a quote of the day
19	Chargen	Returns a string of characters
53	Domain	Domain Name Service (DNS)
67	Bootps	Server port to download bootstrap information
68	Bootpc	Client port to download bootstrap information
69	TFTP	Trivial File Transfer Protocol
111	RPC	Remote Procedure Call
123	NTP	Network Time Protocol
161	SNMP	Simple Network Management Protocol
162	SNMP	Simple Network Management Protocol (trap)

TCP – transmission control protocol

connection oriented protocol

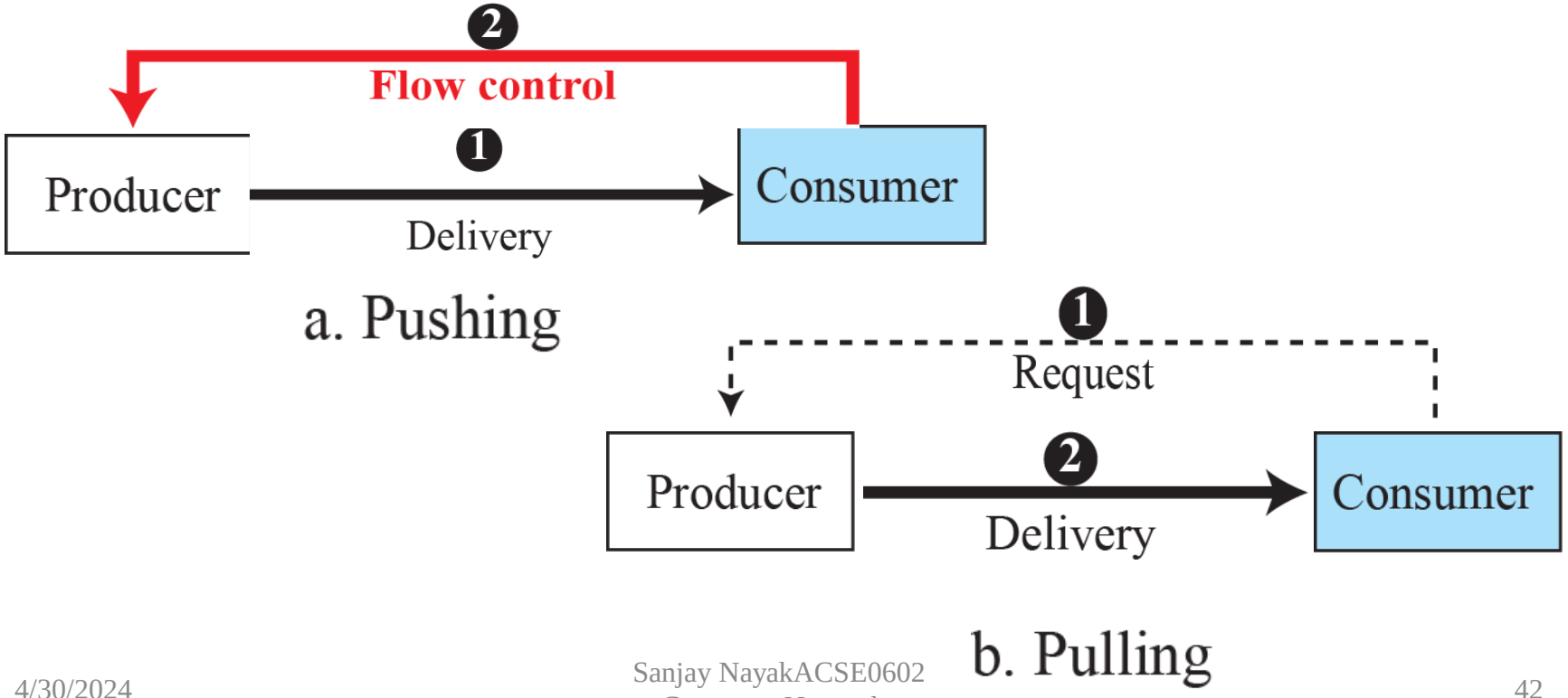
- Provides flow and error control
- receiver can immediately handle any packet it receives
- receiver can never be overwhelmed with incoming packets.
- Three way handshaking : connection establishment , data transfer , connection termination

Connection-oriented service

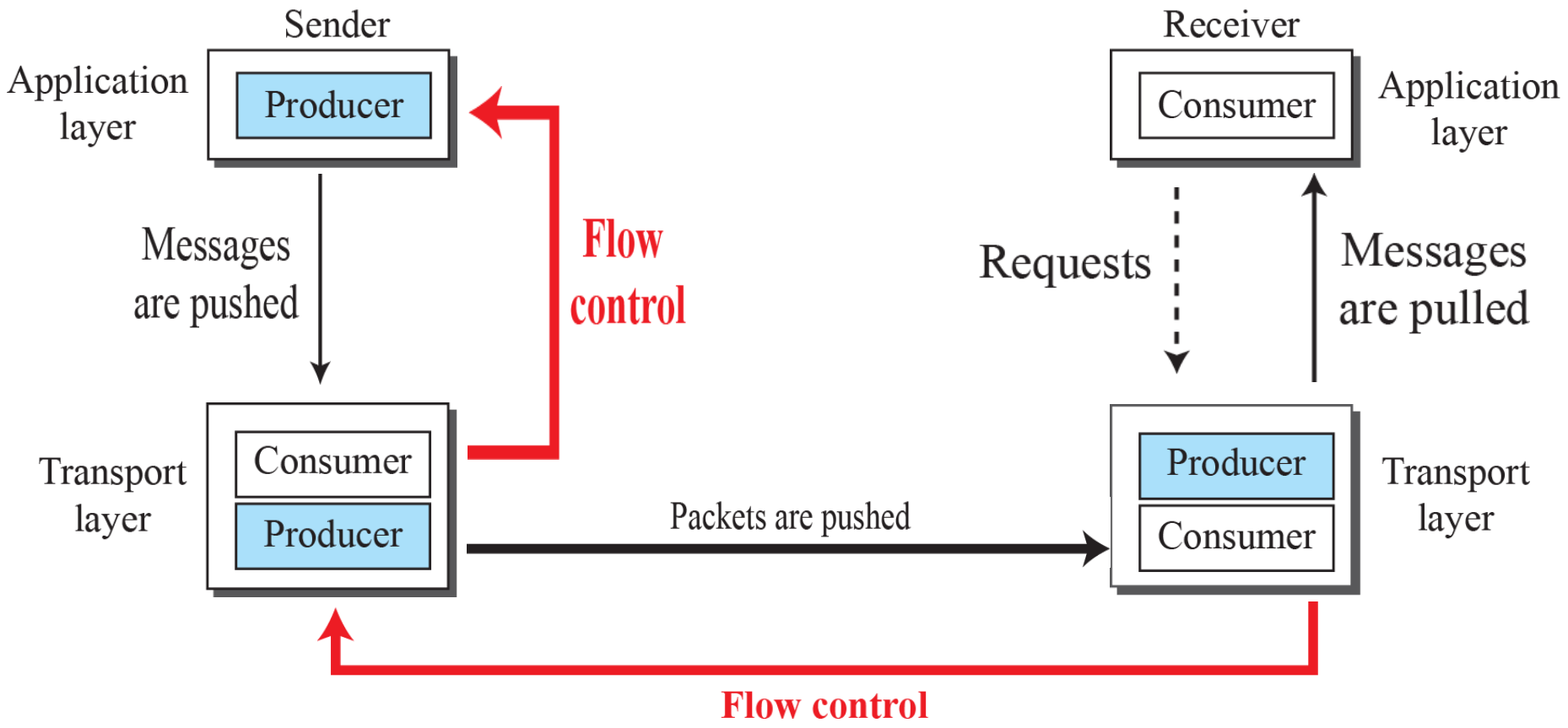


Flow control (Pushing or pulling)

- How much data should be sent by sender to the receiver
- So that Receiver can process it …. How much data should be sent by sender without getting acknowledgement



Flow control at the transport layer



Flow control methods

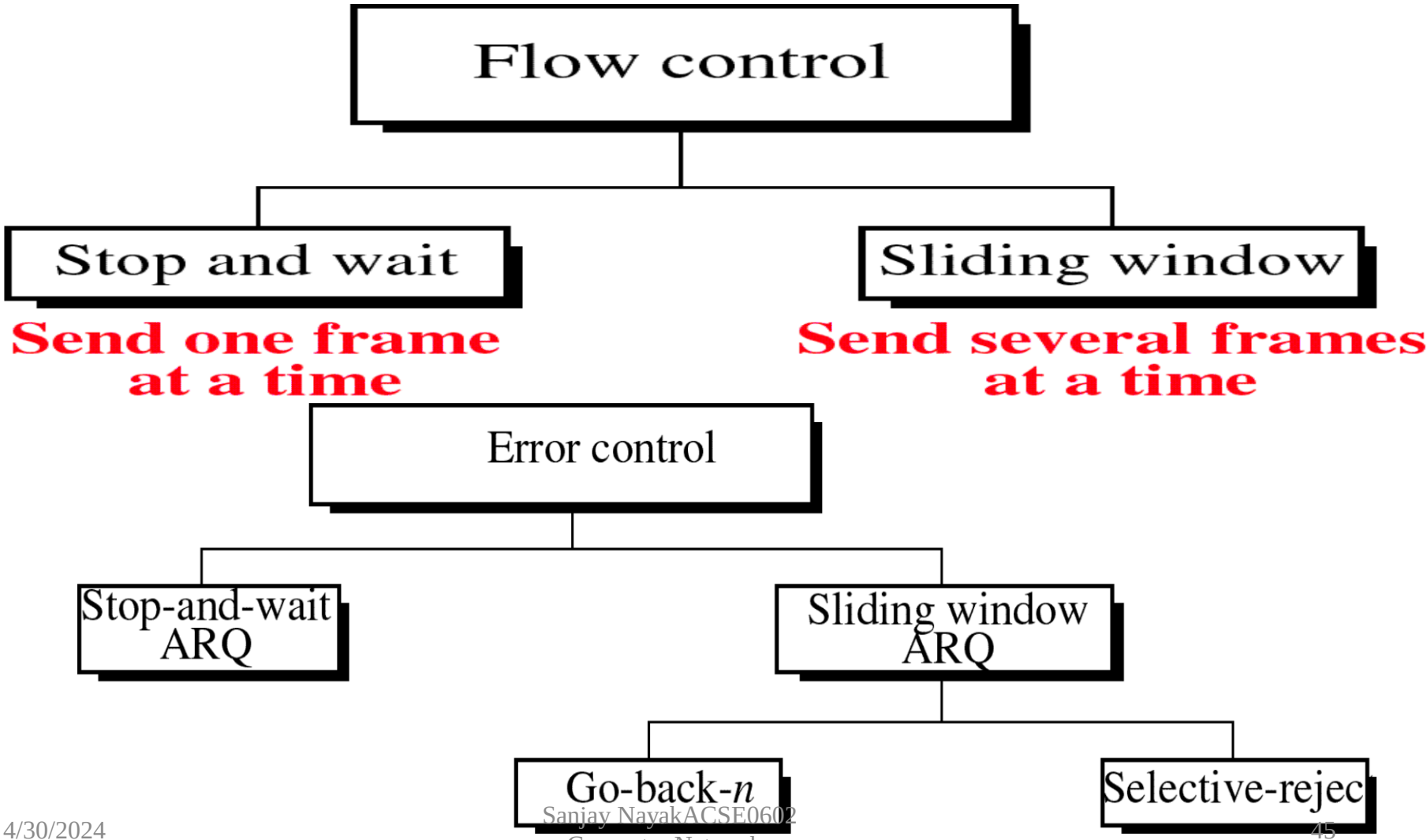
- Simple Protocol
- The simple protocol is a connectionless protocol that provides neither flow nor error control. (unreliable protocol)…fast ….no acknowledgement

Flow control and error control methods

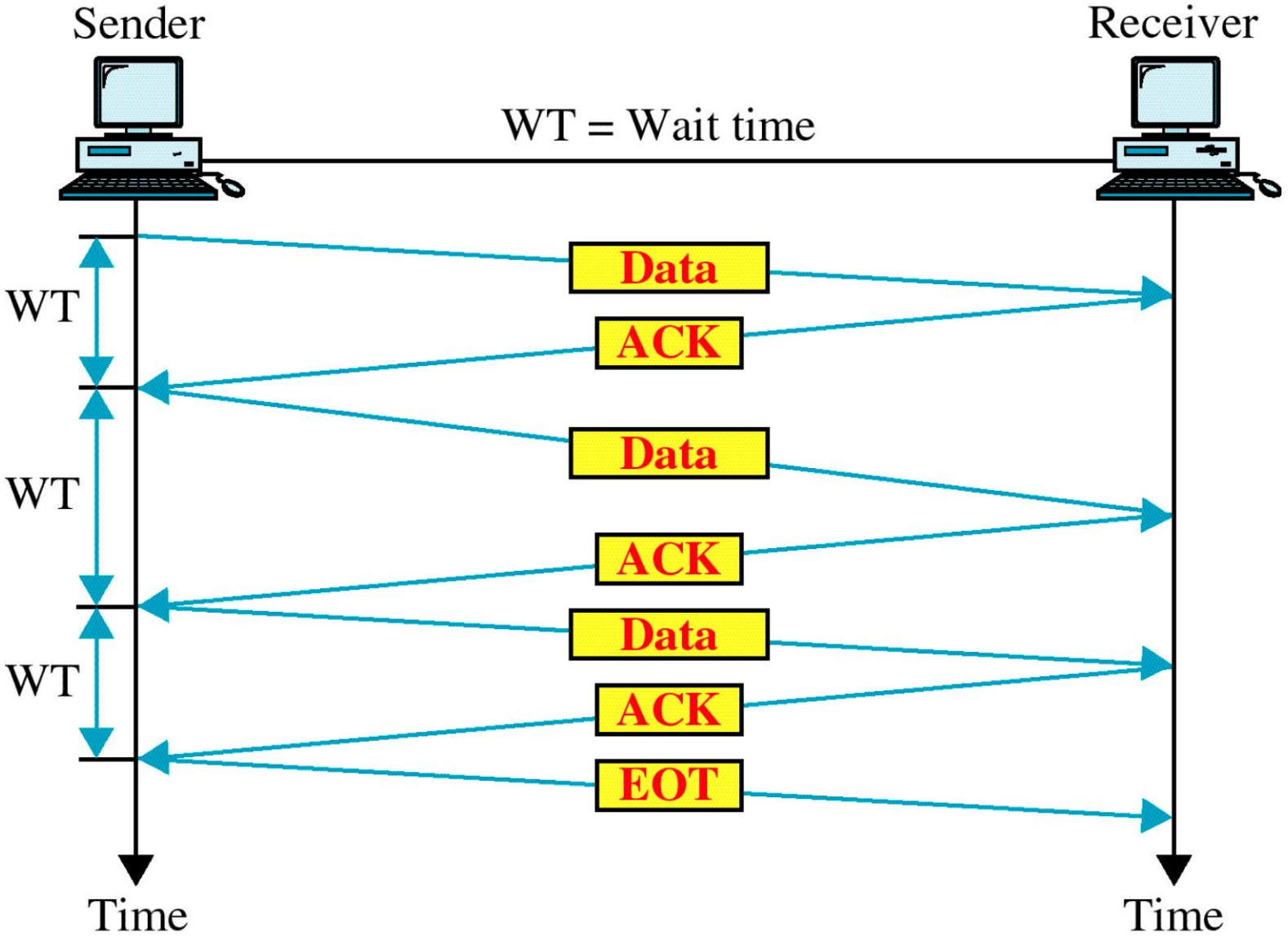
- Stop-and-Wait ARQ(automatic repeat request)
- Go-Back-N ARQ sliding window Protocol
- Selective-Repeat ARQ sliding window Protocol
- Bidirectional Protocols: Piggybacking

Flow control methods

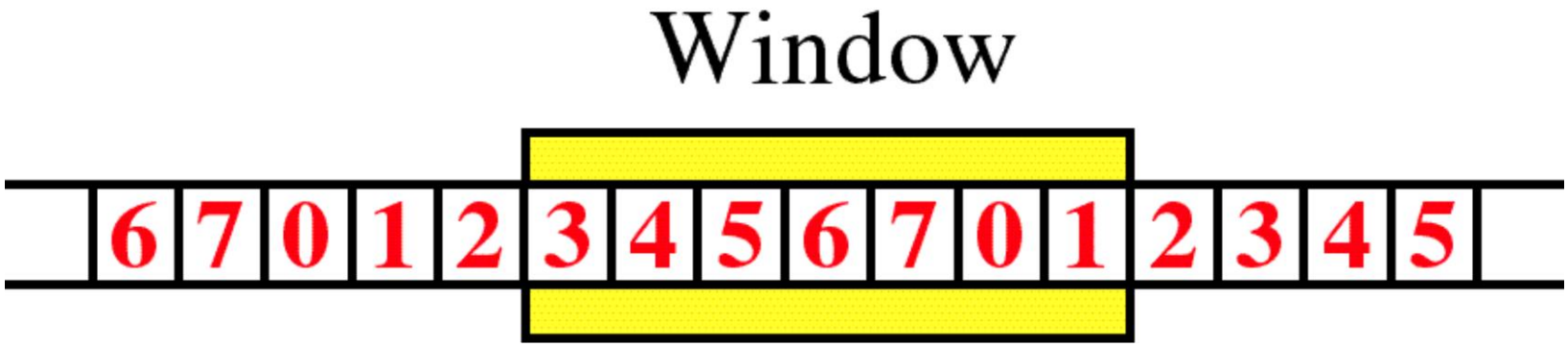
Objective: Study about basic concept of Flow control and Error control



Stop and Wait



Flow control :Sliding Window protocol



Window size : n
Frame no. from: 0 to n

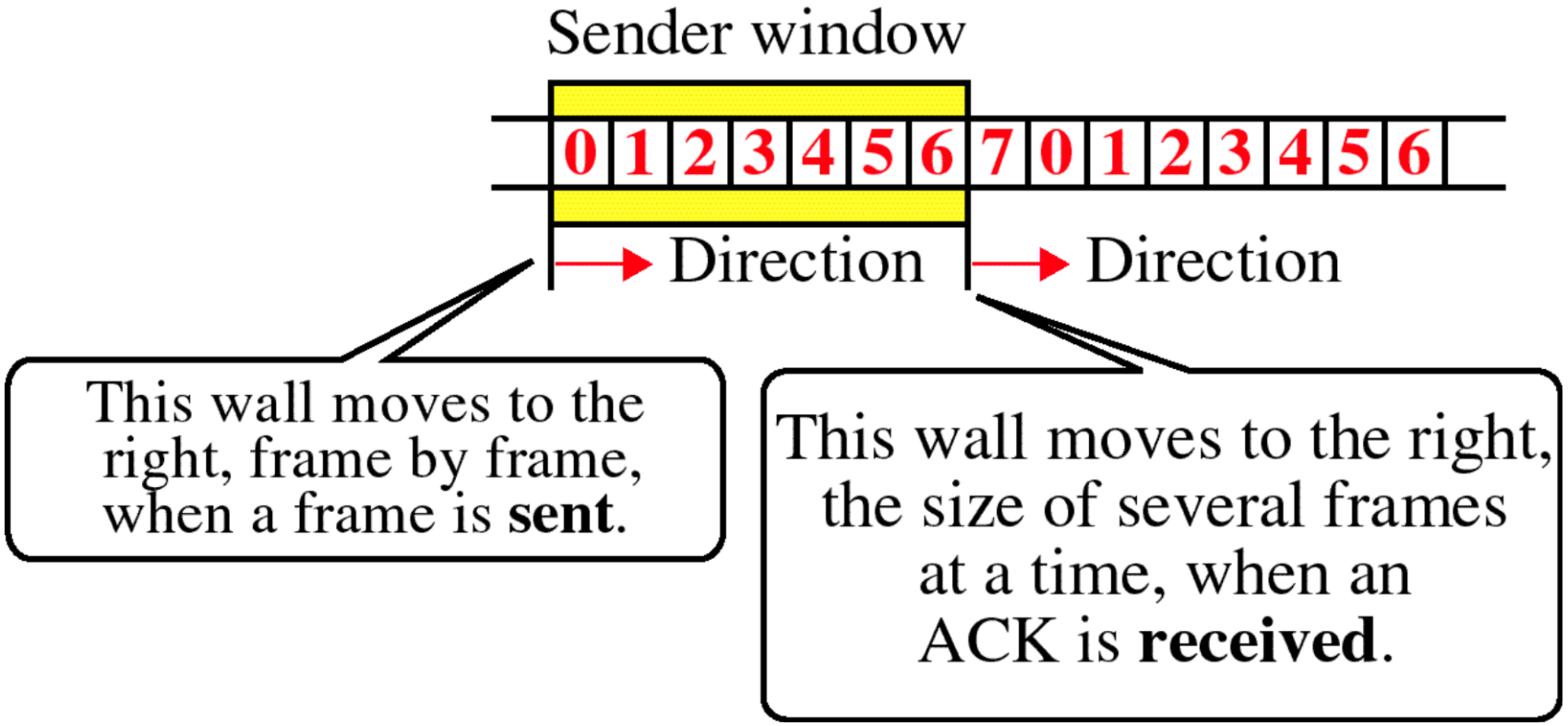
Window size – 7
Frame no. from 0 to 7

7 frames can be transmitted without getting acknowledgement

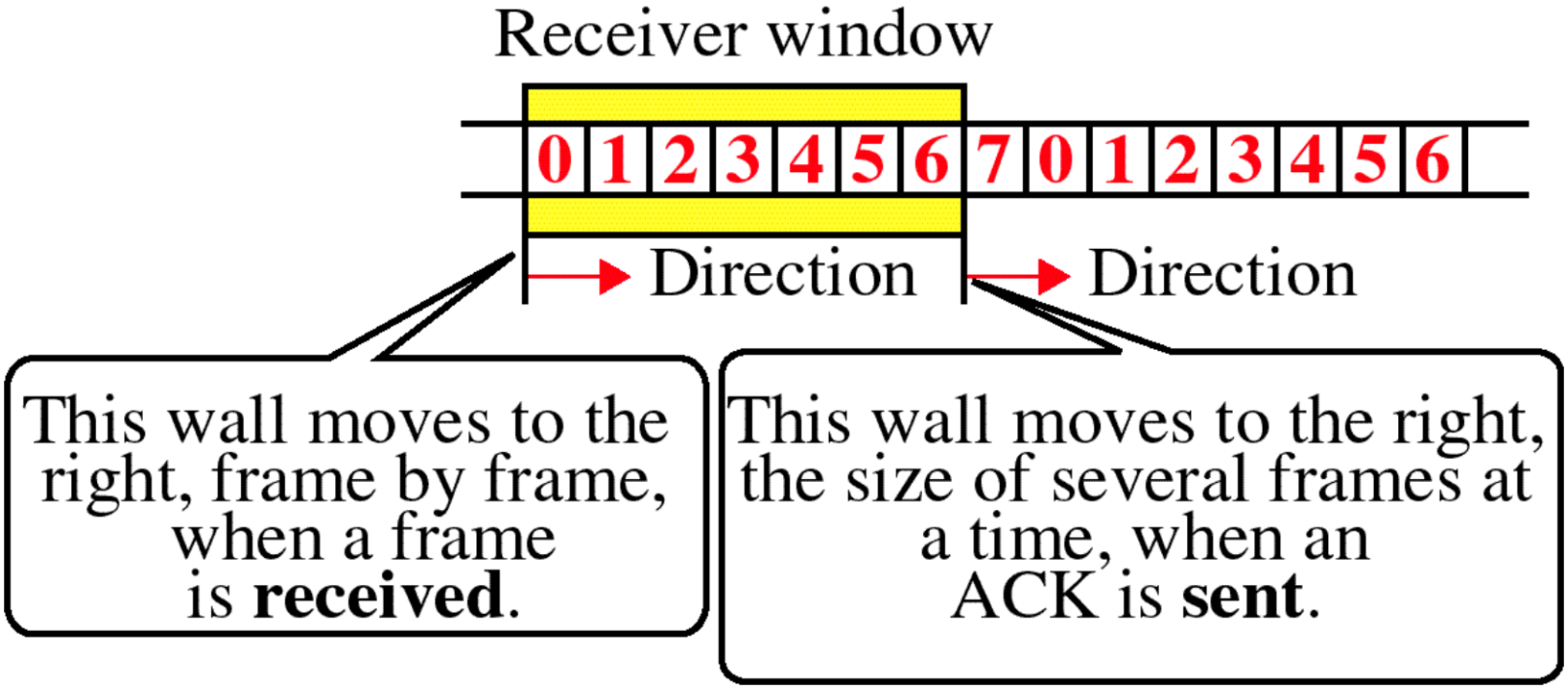
Sender Sliding Window

Window size : n
Frame no. from: 0 to n

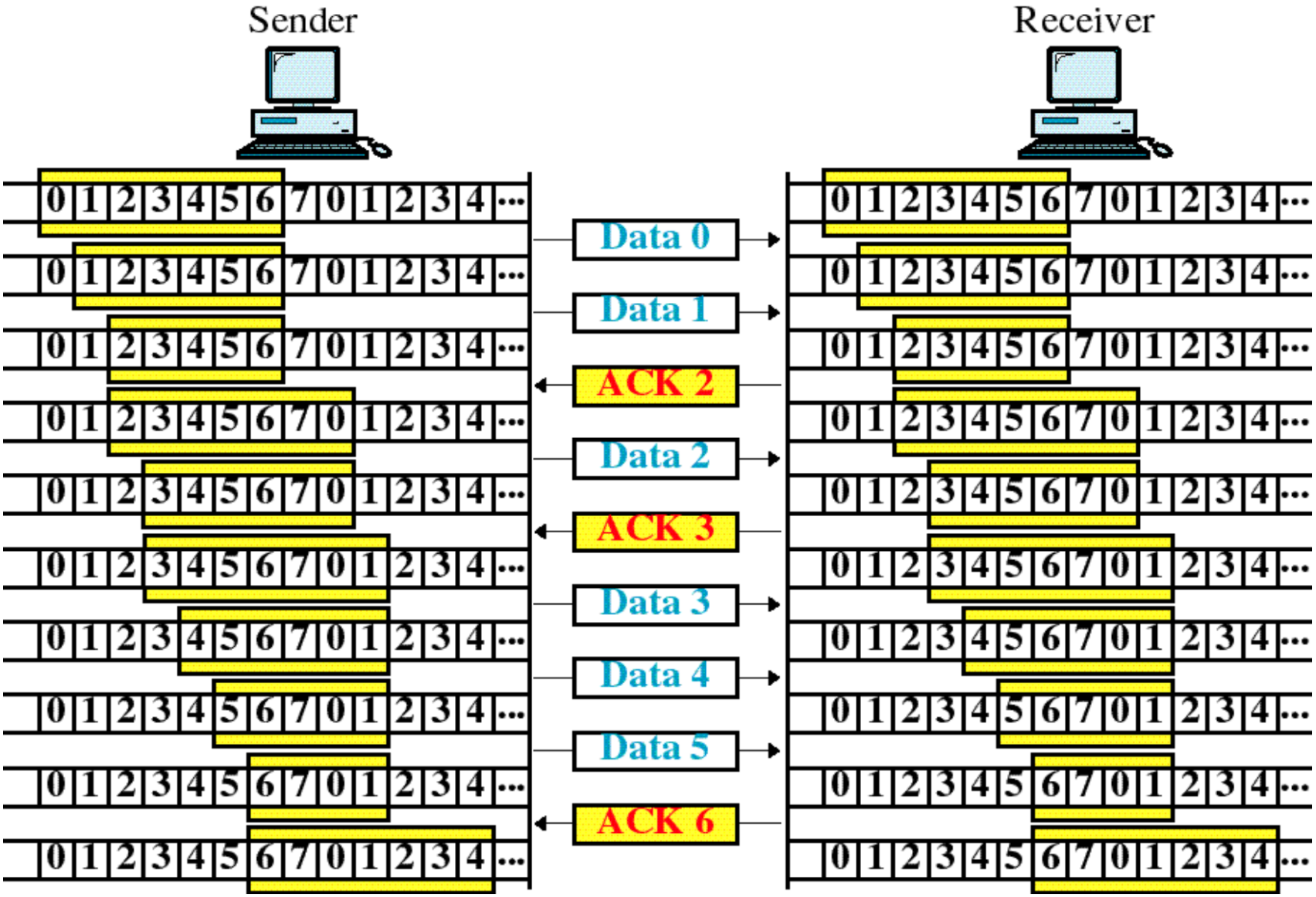
Window size : 7
Frame no. from 0 to 7



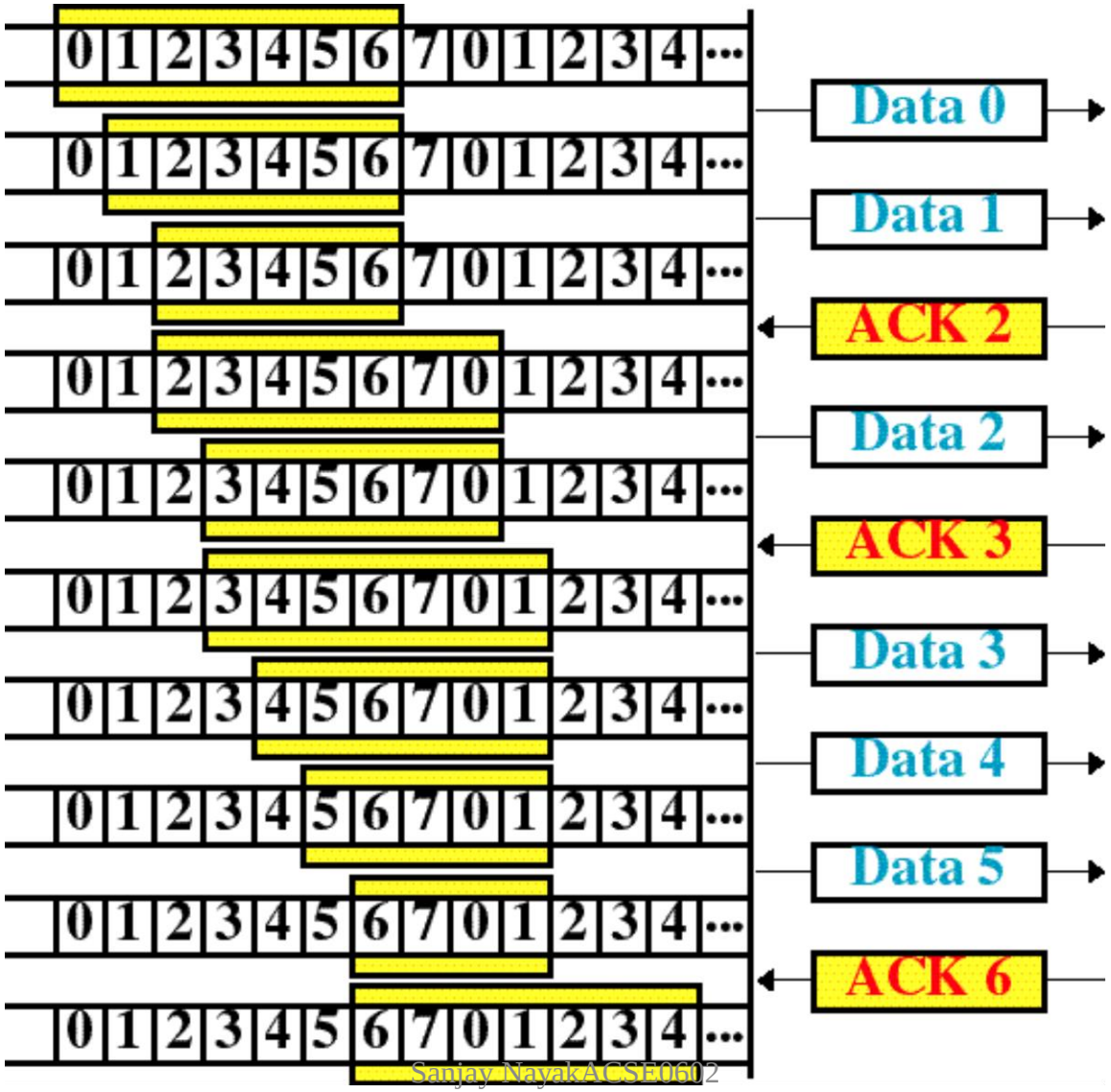
Receiver Sliding Window



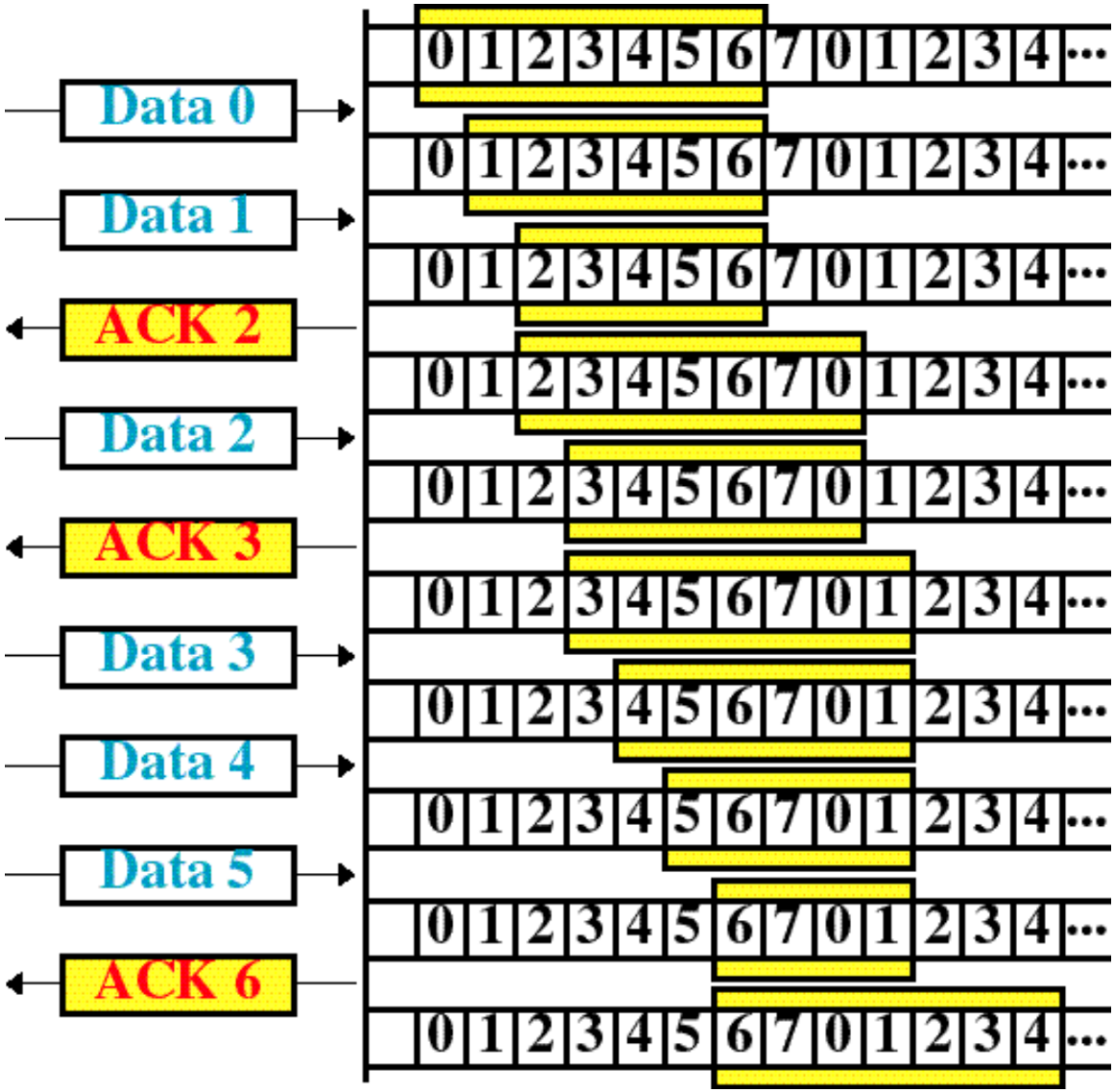
Sliding Window Example



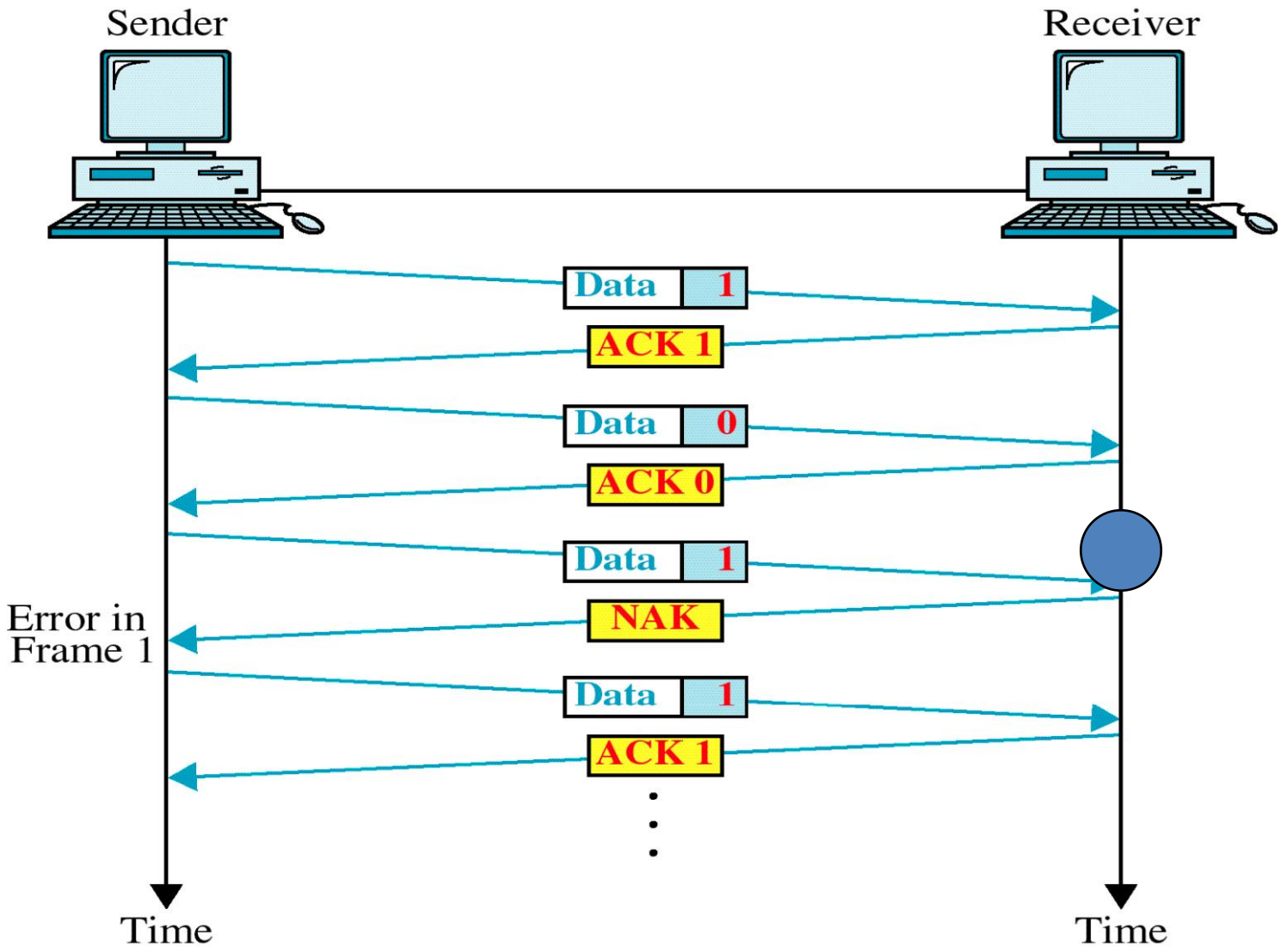
Sender


0 1 2 3 4 5 6 7 0 1 2 3 4 ...
Data 0
Data 1
ACK 2
Data 2
ACK 3
Data 3
Data 4
Data 5
ACK 6

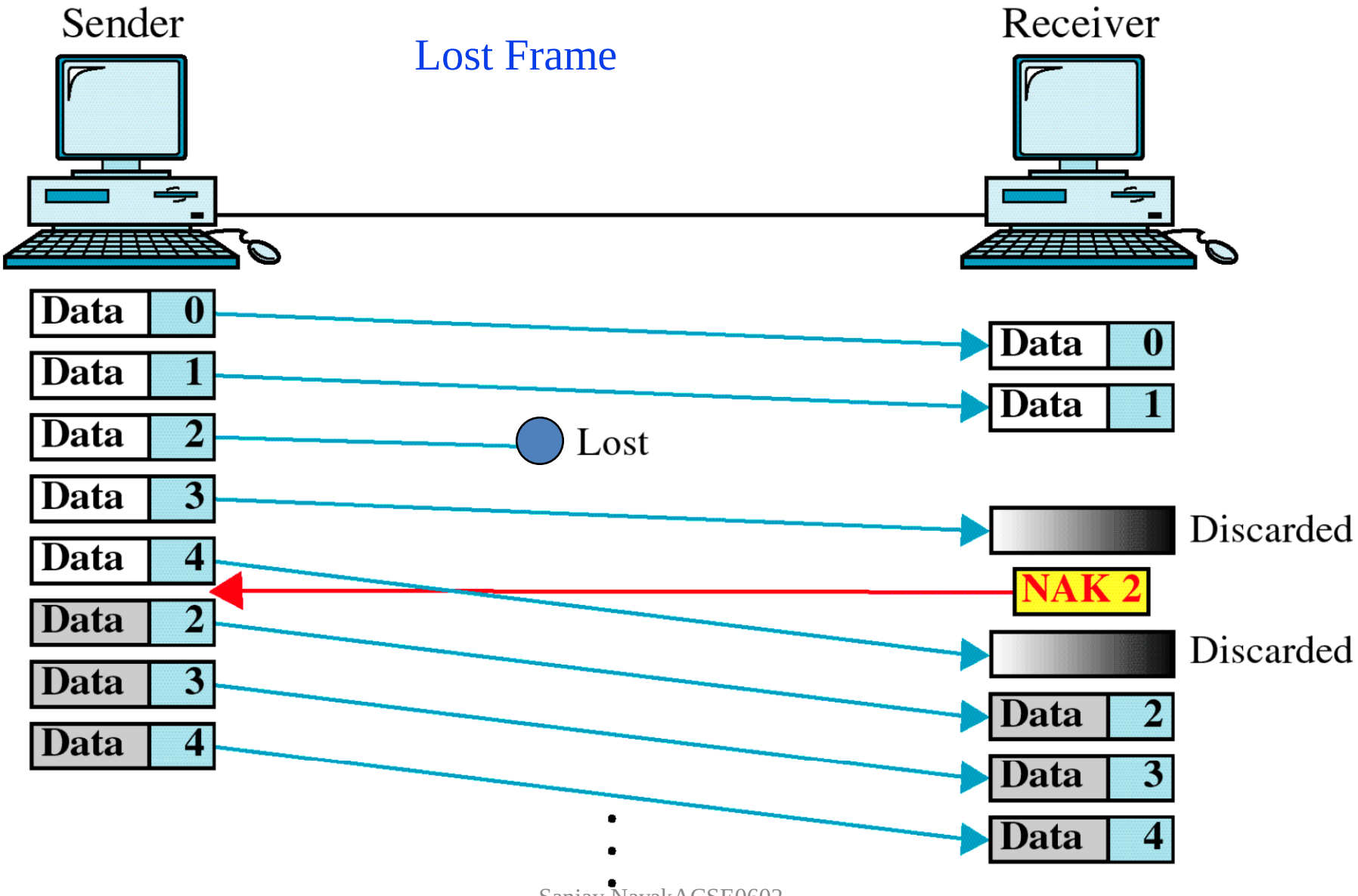
Receiver


Data 0
Data 1
ACK 2
Data 2
ACK 3
Data 3
Data 4
Data 5
ACK 6
0 1 2 3 4 5 6 7 0 1 2 3 4 ...

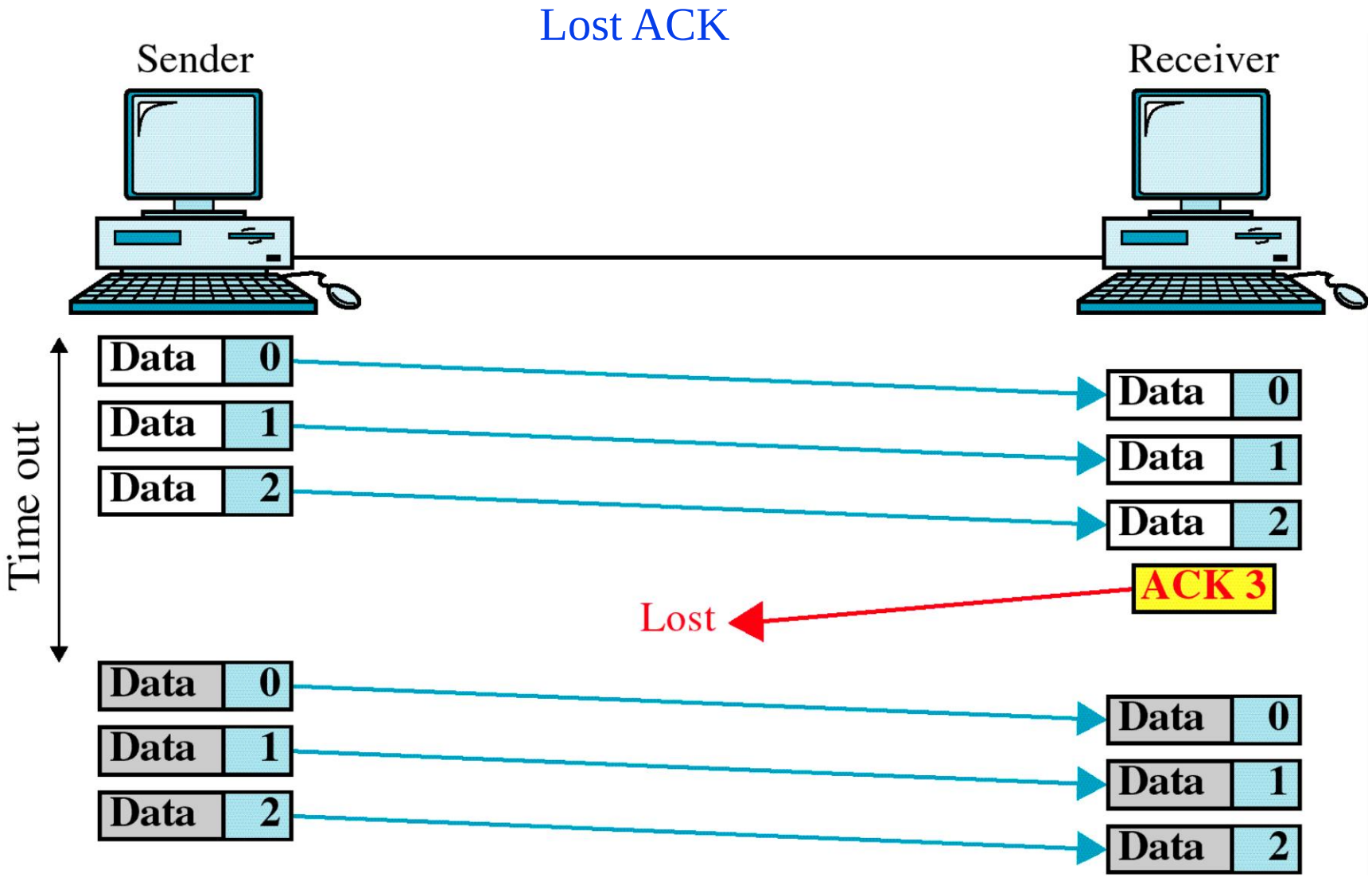
Stop and Wait Protocol



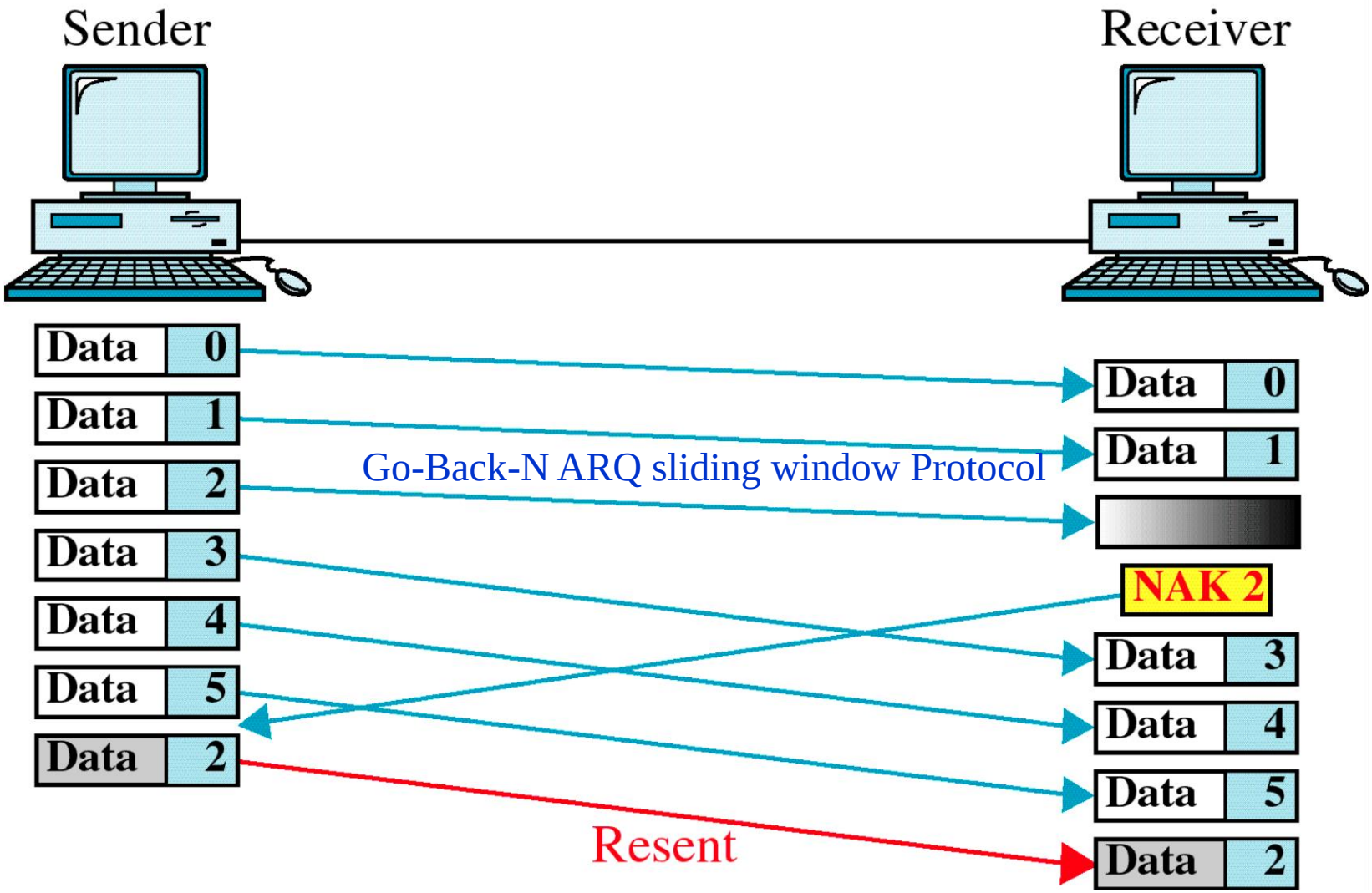
Go-Back-N ARQ sliding window Protocol



Go-Back-N ARQ sliding window Protocol

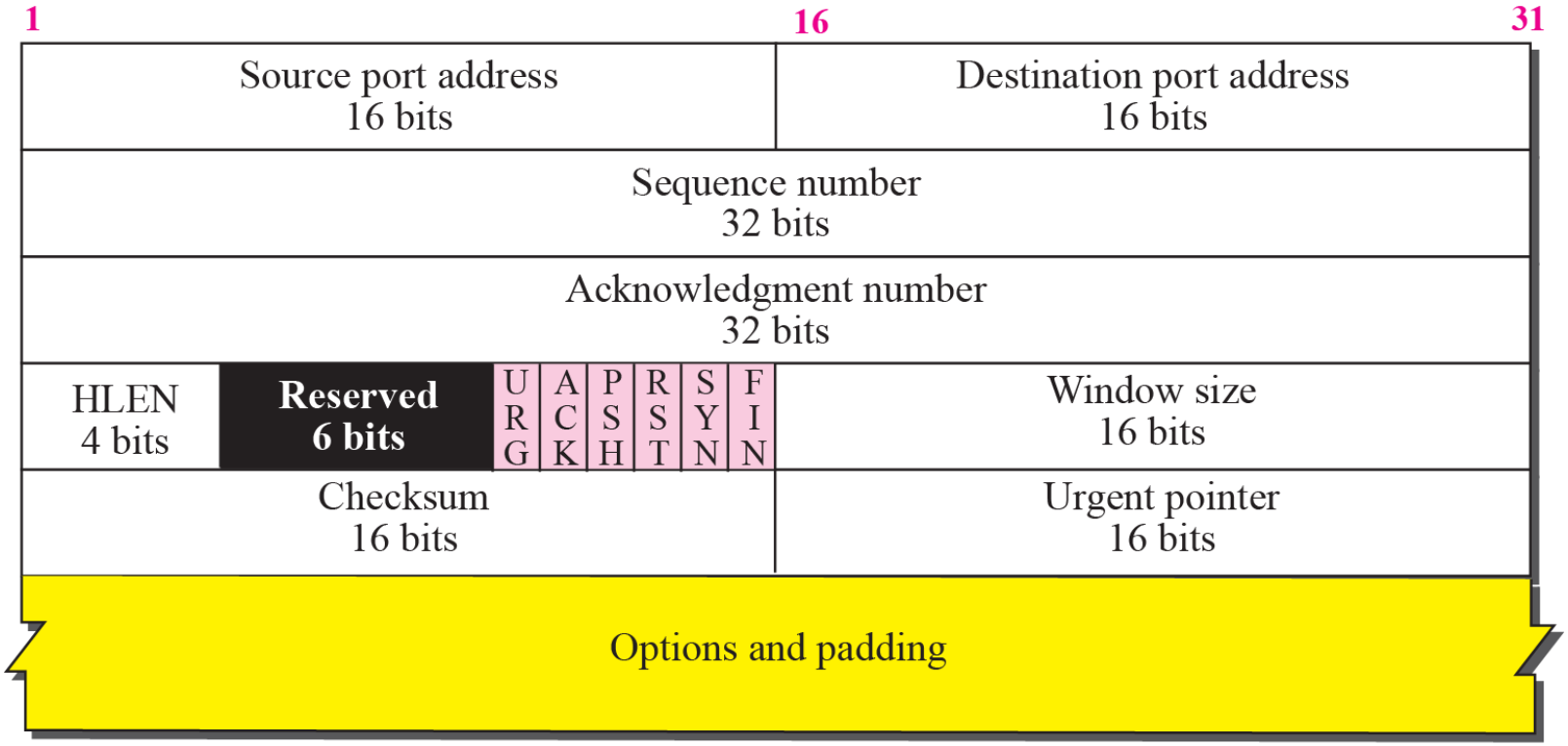


Selective Reject



TCP segment format

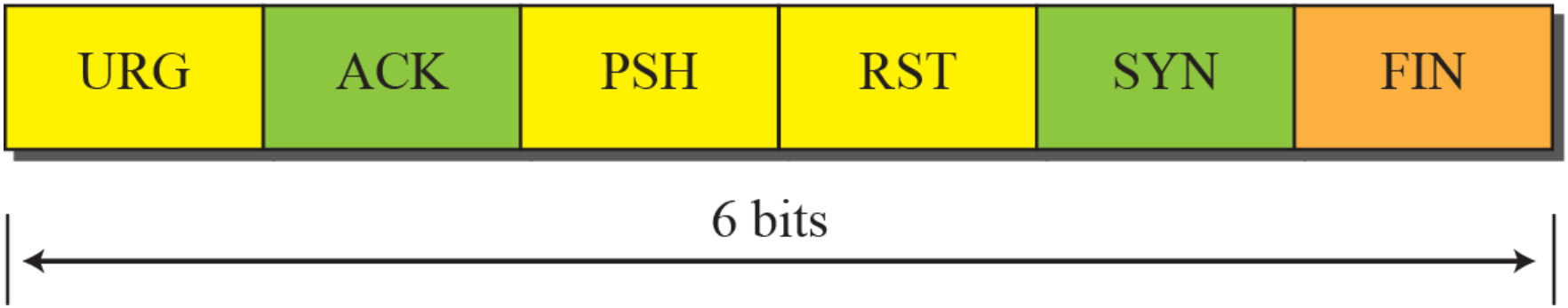
a. Segment



b. Header

Control field

URG: Urgent pointer is valid
ACK: Acknowledgment is valid
PSH: Request for push
RST: Reset the connection
SYN: Synchronize sequence numbers
FIN: Terminate the connection



- URG bit is used to treat certain data on an urgent basis.
- ACK bit indicates whether acknowledgement number field is valid or not.
- PSH bit is used to push the entire buffer immediately to the receiving application.
- RST bit is used to reset the TCP connection.
- SYN bit is used to synchronize the sequence numbers.
- FIN bit is used to terminate the TCP connection.

Transport Layer Protocol :SCTP

Stream Control Transmission Protocol (SCTP) is a new reliable, message-oriented transport-layer protocol.

SCTP is a message-oriented, reliable protocol that combines the best features of UDP and TCP.

Content

Comparison

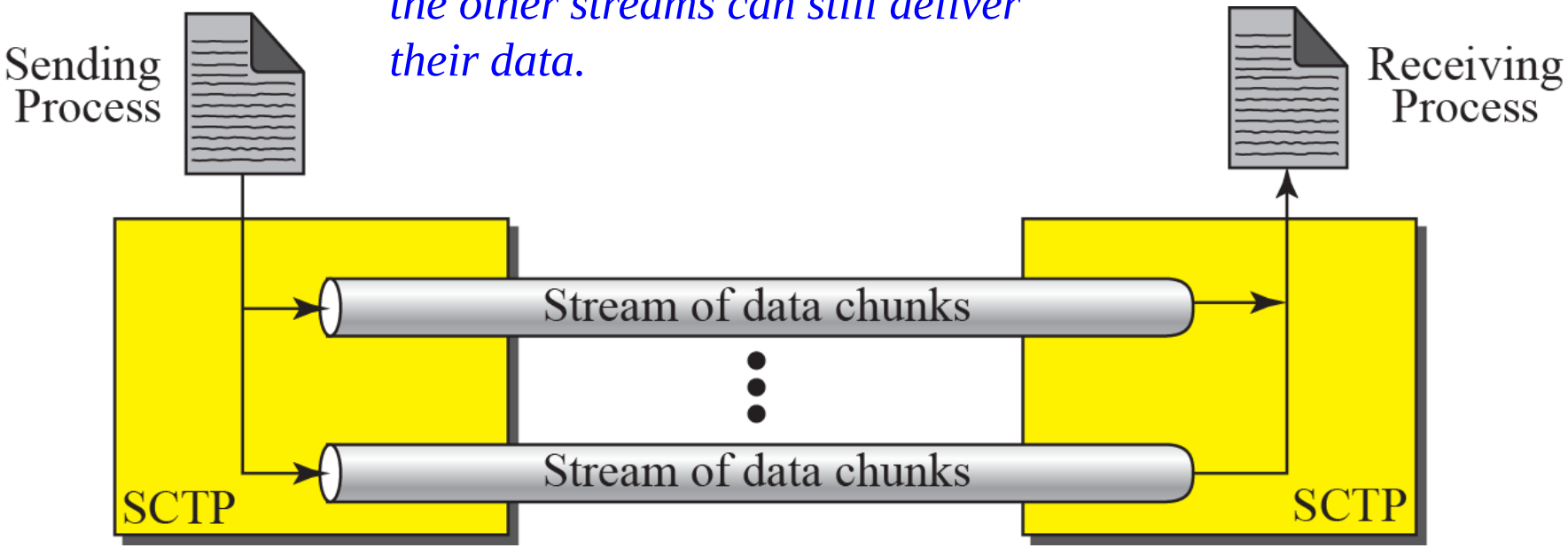
- UDP: Message-oriented, Unreliable
- TCP: Byte-oriented, Reliable
- SCTP
  - Message-oriented, Reliable
  - Other innovative features
    - Association, Data transfer/Delivery
    - Fragmentation, Error/Congestion Control

Services offered by SCTP

- Process-to-Process Communication
- Multiple Streams
- Multi homing
- Full-Duplex Communication
- Connection-Oriented Service
- Reliable Service

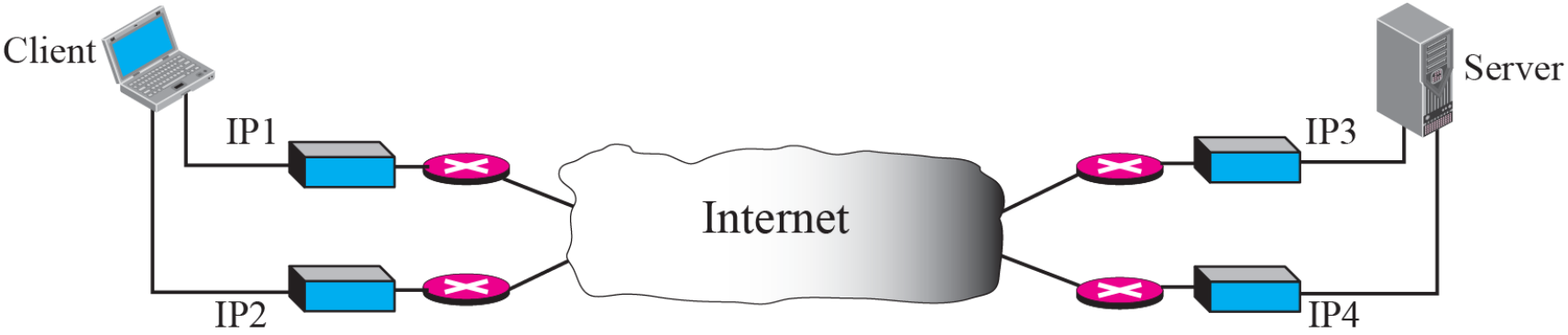
Multiple-stream concept

If one of the streams is blocked, the other streams can still deliver their data.



Multi homing concept

At present, SCTP does not allow load sharing between different path. Currently, it is only for fault-tolerance.

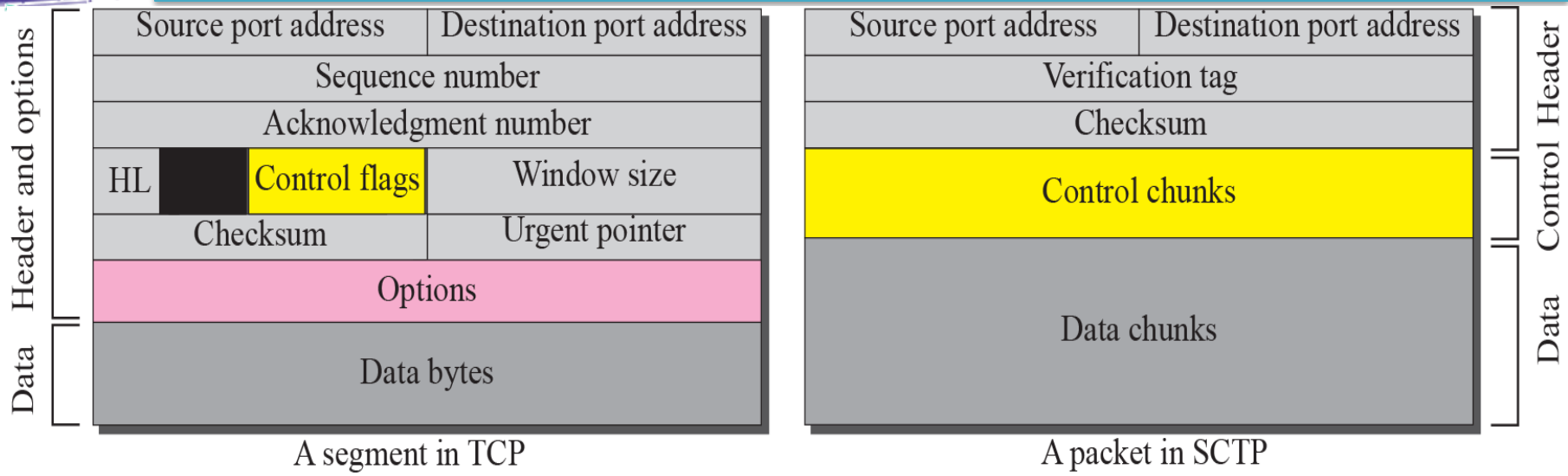


SCTP association allows multiple IP addresses for each end.

Topics Discussed in the Section

- Transmission Sequence Number (TSN)
- Stream Identifier (SI)
- Stream Sequence Number (SSN)
- Packets
- Acknowledgment Number
- Flow Control
- Error Control
- Congestion Control

Comparison between a TCP segment and



In SCTP, a data chunk is numbered using a TSN.

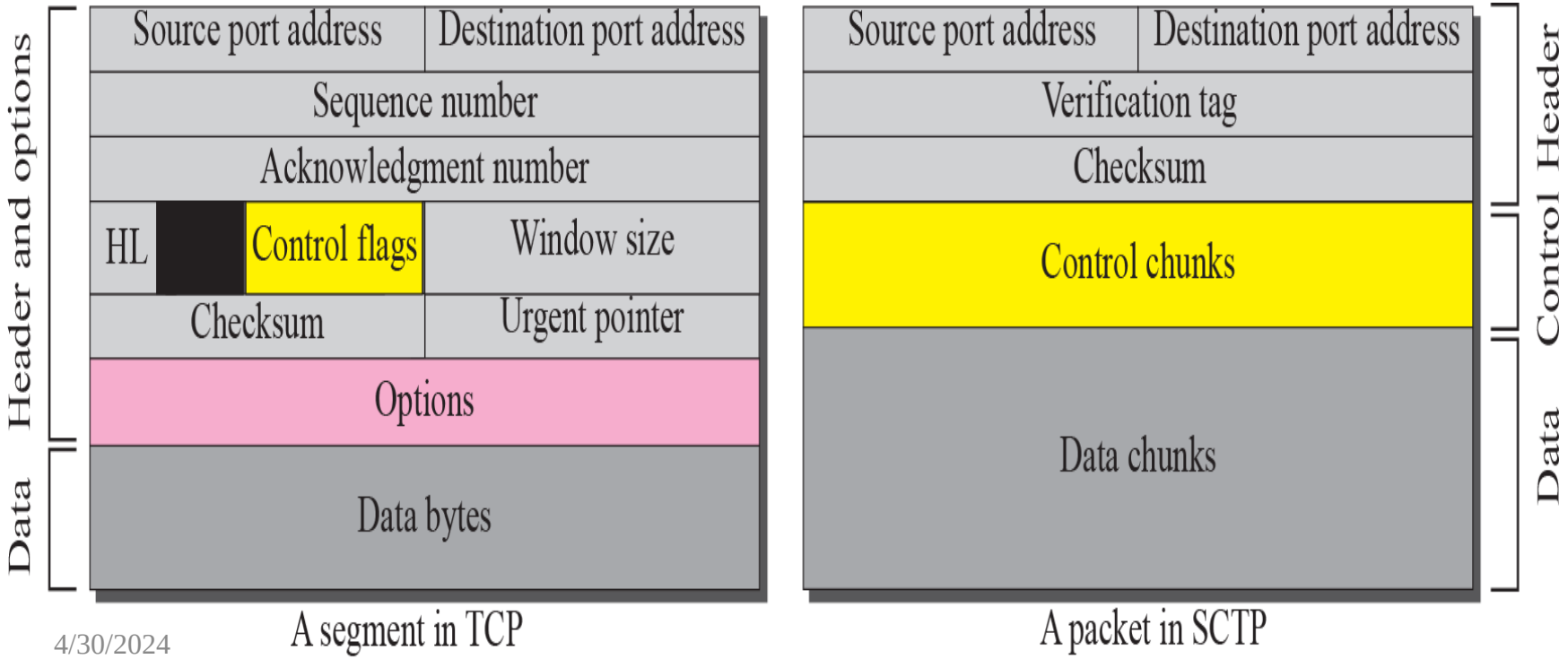
To distinguish between different streams, SCTP uses an SI.

To distinguish between different data chunks belonging to the same stream, SCTP uses SSNs.

- ✓ Transmission Sequence Number (TSN)
- ✓ Stream Identifier (SI)
- ✓ Stream Sequence Number (SSN)

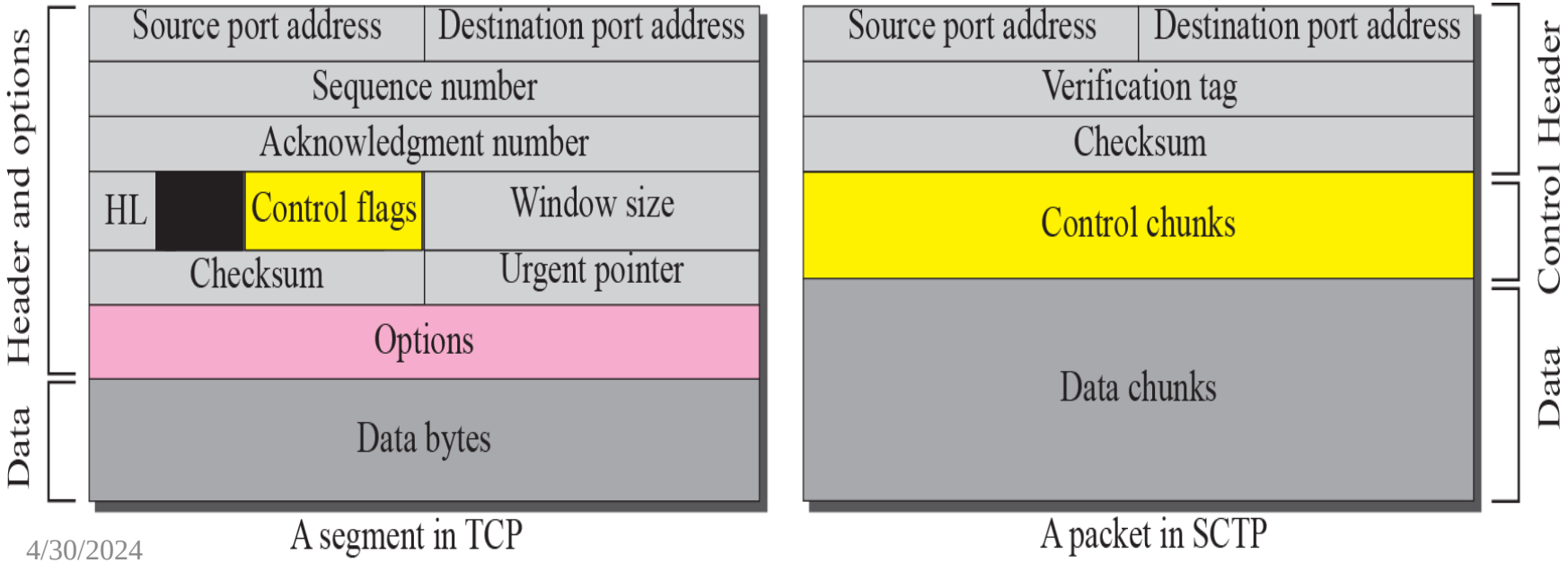
SCTP vs. TCP Content

- Control information
  - TCP: part of the header -- SCTP: several types of control chunks
- Data
  - TCP: one entity in a TCP segment --SCTP: several data chunks in a packet
- Option
  - TCP: part of the header --SCTP: handled by defining new chunk types



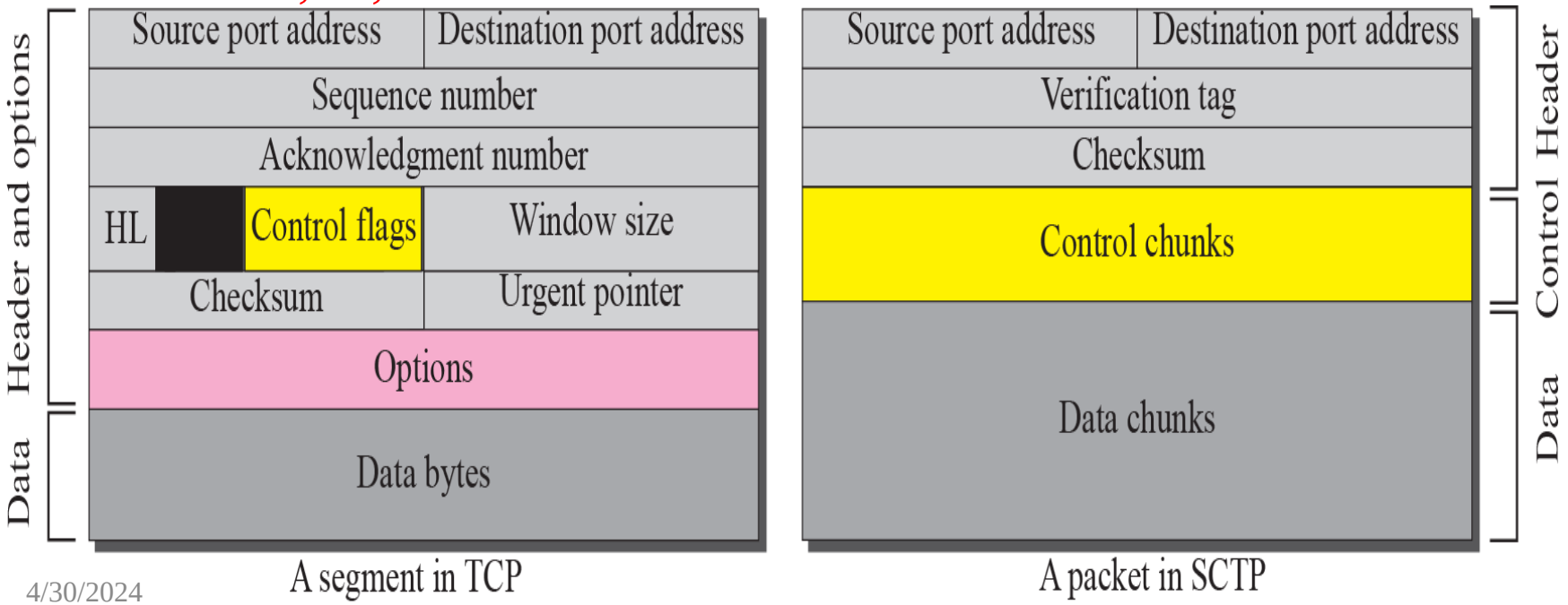
SCTP vs. TCP (2) Content

- Mandatory part of the header
  - TCP: 20 bytes, SCTP: 12 bytes
  - Reason: TSN in data chunk's header, Ack. # and window size are part of control chunk, No need for header length field (∵no option), No need for an urgent pointer
- Checksum
  - TCP: 16 bits, SCTP: 32 bit



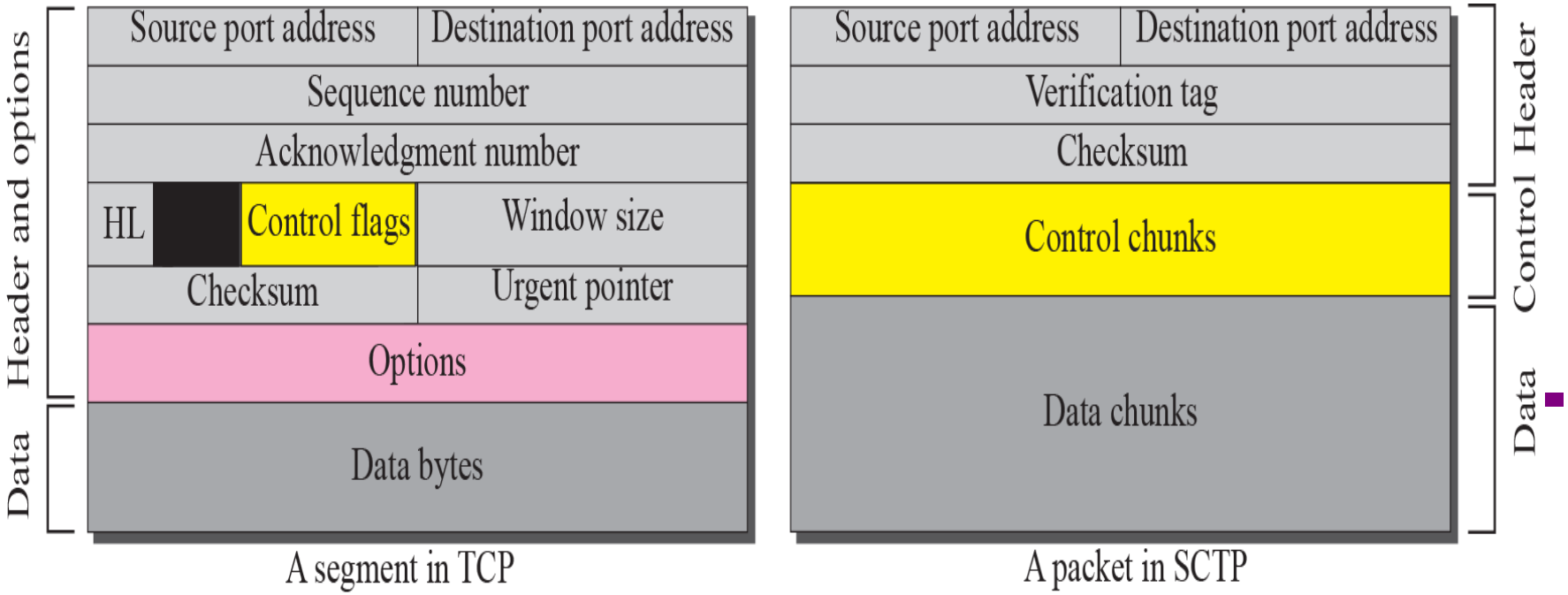
SCTP vs. TCP (3) Content

- Association identifier
  - TCP: none, SCTP: verification tag, Multihoming in SCTP
- Sequence number
  - TCP: one # in the header, SCTP: TSN, SI and SSN define each data chunk
  - TCP:SYN and FIN need to consume one seq. #,Control chunks never use a TSN, SI, or SSN number



SCTP and TCP header comparison

In SCTP, control information and data information are carried in separate chunks.



ERROR CONTROL

SCTP, like TCP, is a reliable transport-layer protocol. It uses a SACK chunk to report the state of the receiver buffer to the sender. Each implementation uses a different set of entities and timers for the receiver and sender sites.

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- Self Made Video Link:

- https://a.impartus.com/ilc/#/video/id/1829352
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  https://a.impartus.com/ilc/#/video/id/1889154
- Youtube/other Video Links
- https://www.youtube.com/watch?v=kAty4mKczEg
- https://www.youtube.com/watch?v=trHox1bN5es

Daily Quiz

1. Transport layer receives data in the form of _____
   a) Packets b) Bits c) Frame d) **TPDU or Segment**
2. ARQ stands for _____
   a) **Automatic Repeat Request** b) Automatic Request Repeat
   c) Application Repeat Request d) Application Request Repeat
3. Socket address found in which layer of OSI model
   a) Physical b) Data Link c) Network d) **Transport**
4. Data Translation and Encryption is main duty of which layer
   a) Data link b) Network c) **Presentation** d) Application
5. RPC protocol and dialogue controller in which layer of OSI model
   a) Network b) Transport c) **Session** d) Presentation

Daily Quiz

6. TCP and UDP protocol work on which layer of OSI model
   a) **Transport** b) Network c) Application d) Data link
7. RSA algorithm is example of
   a) **Asymmetric Encryption** b) Symmetric Encryption
   c) Both A & B d) None
8. Physical address found in which layer of OSI model
   a) Physical b) **Data Link** c) Network d) Transport
9. Error control and Flow control is main duty of which layer
   a) **Data link** b) Network c) Presentation d) Application
10. Which protocol is example of Reliability and Connection oriented
    a) **TCP** b) UDP c) Both d) None

Weekly Assignment

1. List the steps in connection establishment in TCP. (CO5)
2. How asymmetric key is useful? (CO5)
3. What do you mean by confidentiality and integrity? (CO5)
4. What is DoS attack? (CO5)
5. How confidentiality can be achieved? Name the methods. (CO5)

MCQ s

1. An endpoint of an inter-process communication flow across a computer network is called:

A. socket

B. pipe

C. port

D. none of the mentioned

2. A(n)_____is keyless transposition cipher with N inputs and M outputs that uses a table to define the relationship between input stream and the output stream

A. S-box

B. P-box

C. T-box

D. none

MCQ s

3. UDP uses _____to handle incoming user datagram that go to different processes on the same hosts

   A. flow control

   B. multiplexing

   C. demultiplexing

   D. None

4. UDP packets have fixed size header of ……bytes

   A. 6

   B. 8

   C. 40

   D. none of the above

MCQ s

Multiple Choice Questions (Transport Layer)

1. Which of the following is false with respect to UDP?
a) Connection-oriented
b) Unreliable
c) Transport layer protocol
d) Low overhead

Answer: a
Explanation: UDP is an unreliable, connectionless transport layer protocol that provides message-based data transmission. TCP is an example of connection-oriented protocols.

2. 2. Return value of the UDP port “Chargen” is _____
a) String of characters
b) String of integers
c) Array of characters with integers
d) Array of zero’s and one’s

Answer: a
Explanation: Using Chargen with UDP on port 19, the server sends a UDP datagram containing a random number of characters every time it receives a datagram from the connecting host. The number of characters is between 0 and 512.

MCQ s

3. Beyond IP, UDP provides additional services such as _____
a) Routing and switching
b) Sending and receiving of packets
c) Multiplexing and demultiplexing
d) Demultiplexing and error checking

Answer: d
Explanation: De-multiplexing is the delivering of received segments to the correct application layer processes at the recipients end using UDP. Error checking is done through checksum in UDP.

4. 4. What is the main advantage of UDP?
a) More overload
b) Reliable
c) Low overhead
d) Fast

Answer: c
Explanation: As UDP does not provide assurance of delivery of packet, reliability and other services, the overhead taken to provide these services is reduced in UDP's operation. Thus, UDP provides low overhead, and higher speed.

MCQ s

5. Port number used by Network Time Protocol (NTP) with UDP is _____
a) 161
b) 123
c) 162
d) 124

Answer: b
Explanation: The Network Time Protocol is a clock synchronization network protocol implemented by using UDP port number 123 to send and receive time stamps.

6. What is the header size of a UDP packet?
a) 8 bytes
b) 8 bits
c) 16 bytes
d) 124 bytes

Answer: a
Explanation: The fixed size of the UDP packet header is 8 bytes. It contains four two-byte fields: Source port address, Destination port address, Length of packet, and checksum.

MCQ s

7. The port number is “ephemeral port number”, if the source host is _____
a) NTP
b) Echo
c) Server
d) Client

Answer: d
Explanation: Port numbers from 1025 to 5000 are used as ephemeral port numbers in Windows Operating System. Ephemeral port numbers are short-lived port numbers which can be used for clients in a UDP system where there are temporary clients all the time.

8. “Total length” field in UDP packet header is the length of _____
a) Only UDP header
b) Only data
c) Only checksum
d) UDP header plus data

Answer: d
Explanation: Total length is the 16 bit field which contains the length of UDP header and the data. The maximum value of the Total length field and the maximum size of a UDP datagram is 65,535 bytes (8 byte header + 65,527 bytes of data).

MCQ s

9. Which is the correct expression for the length of UDP datagram?
a) UDP length = IP length – IP header's length
b) UDP length = UDP length – UDP header's length
c) UDP length = IP length + IP header's length
d) UDP length = UDP length + UDP header's length

Answer: a
Explanation: A user datagram is encapsulated in an IP datagram. There is a field in the IP header that defines the total length of the IP packet. There is another field in the IP header that defines the length of the header. So if we subtract the length of the IP header that is encapsulated in the IP packet, we get the length of UDP datagram.

10. The _____ field is used to detect errors over the entire user datagram.
a) udp header
b) checksum
c) source port
d) destination port

Answer: b
Explanation: Checksum field is used to detect errors over the entire user datagram. Though it is not as efficient as CRC which is used in TCP, it gets the job done for the UDP datagram as UDP doesn't have to ensure the delivery of the packet.

Old Question Papers

- https://firstranker.com/fr.php/frdA290120A17171122/download-aktu-b-tech-6th-sem-2018-2019-KCS603-computer-network-question-paper
- ACSE0602 CN.docx (sharepoint.com)

Expected Questions for University Exam

1. List all the methods of flow control on transport layer
2. Name the parameters of TCP header.
3. How piggybacking is useful?
4. Callie wants to send the message M = 13 to Alice. Using Alice's public and private keys, calculate the ciphertext C, and the value for R when Alice recovers the message. Use RSA method.
5. How SCTP is different from TCP and UDP?
6. In Stop and wait protocol every 4^{th} packet is lost and we need to send total 10 packets so how many transmissions it took to send all the packets?

Summary

In this unit we have studied functions of transport layer and port addressing.
TCP/UDP protocols in detail and SCTP protocol for transport Layer.
We have also covered network security issues and encryption decryption methods

Recap of Unit

- Transport Layer: Process-to-process delivery
- Transport layer protocols (UDP and TCP)
- UDP header format
- TCP header Format
- Port addressing
- Multiplexing, Connection management
- Flow control and retransmission
- Window management
- TCP Congestion control
- Quality of service

References

Books:

1. Forouzen, "Data Communication and Networking",TMH

2. A.S. Tanenbaum, Computer Networks, Pearson Education

3. W. Stallings, Data and Computer Communication, MacmillanPress

Thank You