RTMENT OF INFORMATION TECHNOLOGY

19CSB302 – COMPUTER NETWORKS

III YEAR V SEM

UNIT 3 – TRANSPORT LAYER

TOPIC 16 –Transport Layer Services

...ntrol Transmission Protocol (SCTP) is

...ble, message-oriented transport lay...
...SCTP, however, is mostly design...
...applications that have recently...
...These new applications need a...
...d service than TCP can provide.

TP is a message-oriented, reliab
ol that combines the best featu
UDP and TCP.

.4 *Some SCTP applications*

Port Number	Description
9990	ISDN over IP
2904	SS7 telephony signaling
2905	SS7 telephony signaling
2945	Media gateway control
1718, 1719, 1720, 11720	IP telephony
5060	IP telephony

Rec
pr
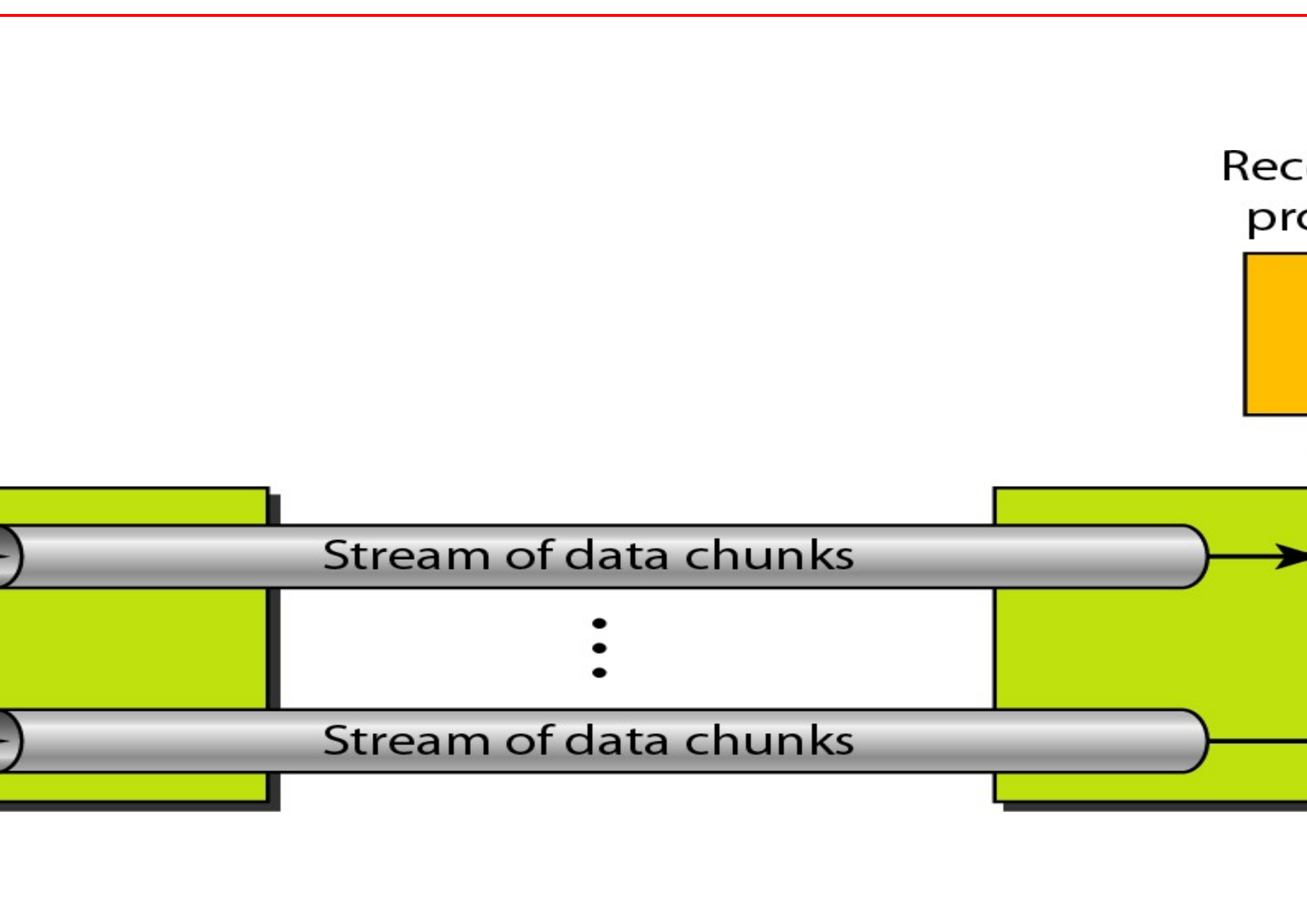
Stream of data chunks
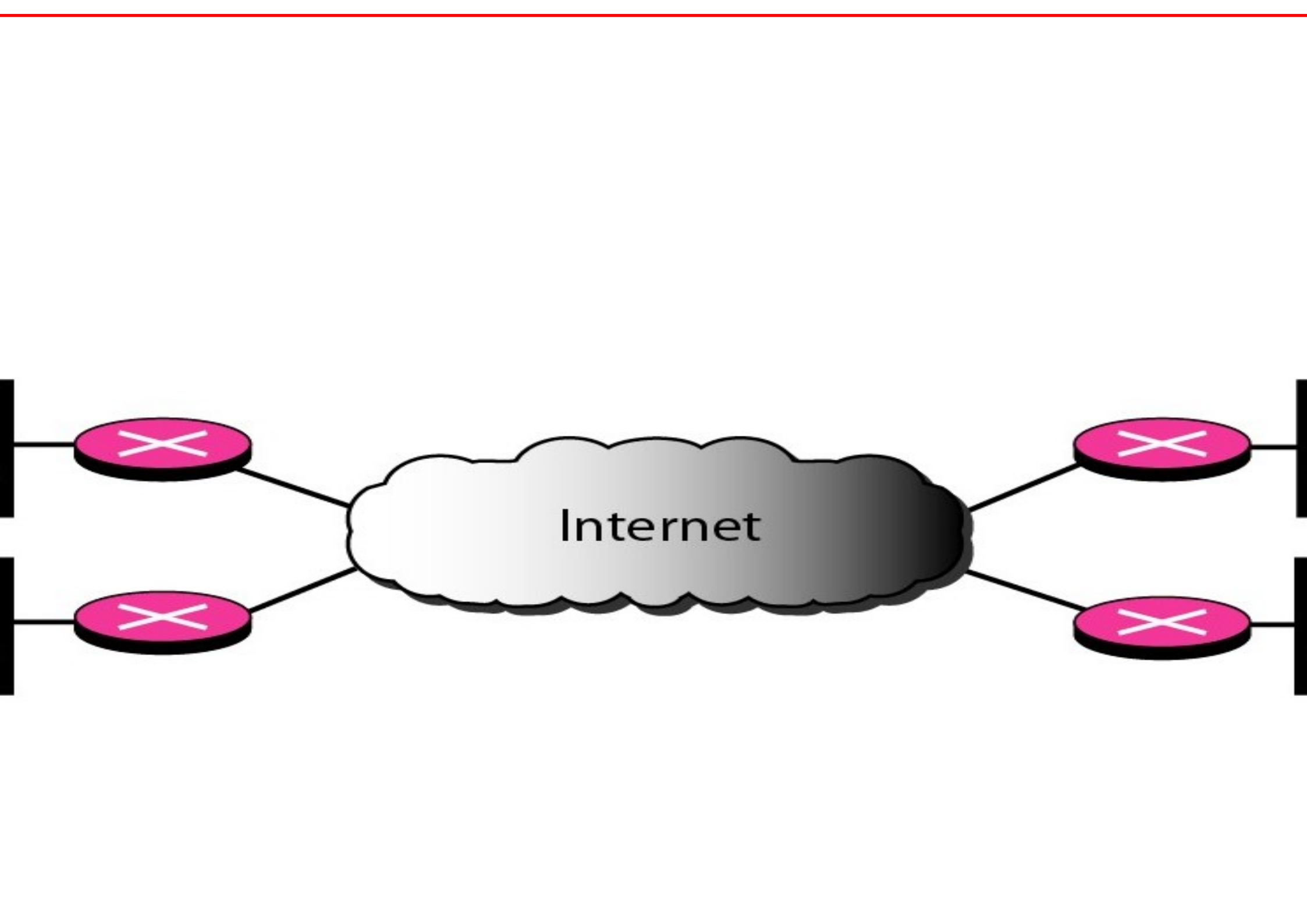
Stream of data chunks

ssociation in SCTP can involve multiple streams.

Internet

P association allows multiple IP addresses for each end.

CTP, a data chunk is numbered using a TSN.

distinguish between different streams, SCTP uses an SI.

distinguish between different da
nks belonging to the same strea
SCTP uses SSNs.

as segments; SCTP has packets

dress	Destination port address
quence number	
wledgment number	
I flags	Window size
	Urgent pointer
Options	
Data bytes	

egment in TCP

Source port address	Destinat
Verification tag	
Checksum	
Control chunks	
Data chunks	

A packet in SCTF

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

Third packet

Header
Control chunks
TSN: 107 SI: 1   SSN: 2
TSN: 108 SI: 2   SSN: 0
TSN: 109 SI: 2   SSN: 1

Second packet

Header
Control chunks
TSN: 104 SI: 0   SSN: 3
TSN: 105 SI: 1   SSN: 0
TSN: 106 SI: 1   SSN: 1

Stream 2

Stream 1

Stream 0

Flow of packets from sender to receiver

ata chunks are identified by thre
items: TSN, SI, and SSN.

s a cumulative number identifyin

ciation; SI defines the stream;

defines the chunk in a stream.

P, acknowledgment numbers are

knowledge only data chunks; co
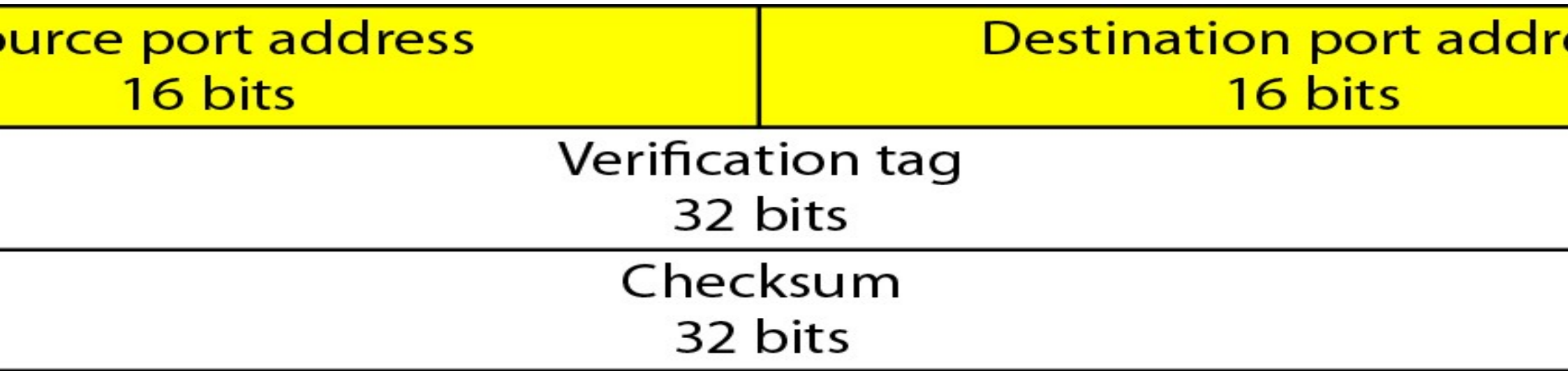
s are acknowledged by other c

chunks if necessary.

General header
(12 bytes)

Chunk 1
(variable length)

⋮

Chunk N
(variable length)

CTP packet, control chunks con
before data chunks.

Source port address 16 bits	Destination port address 16 bits
Verification tag 32 bits	
Checksum 32 bits	

Chunks

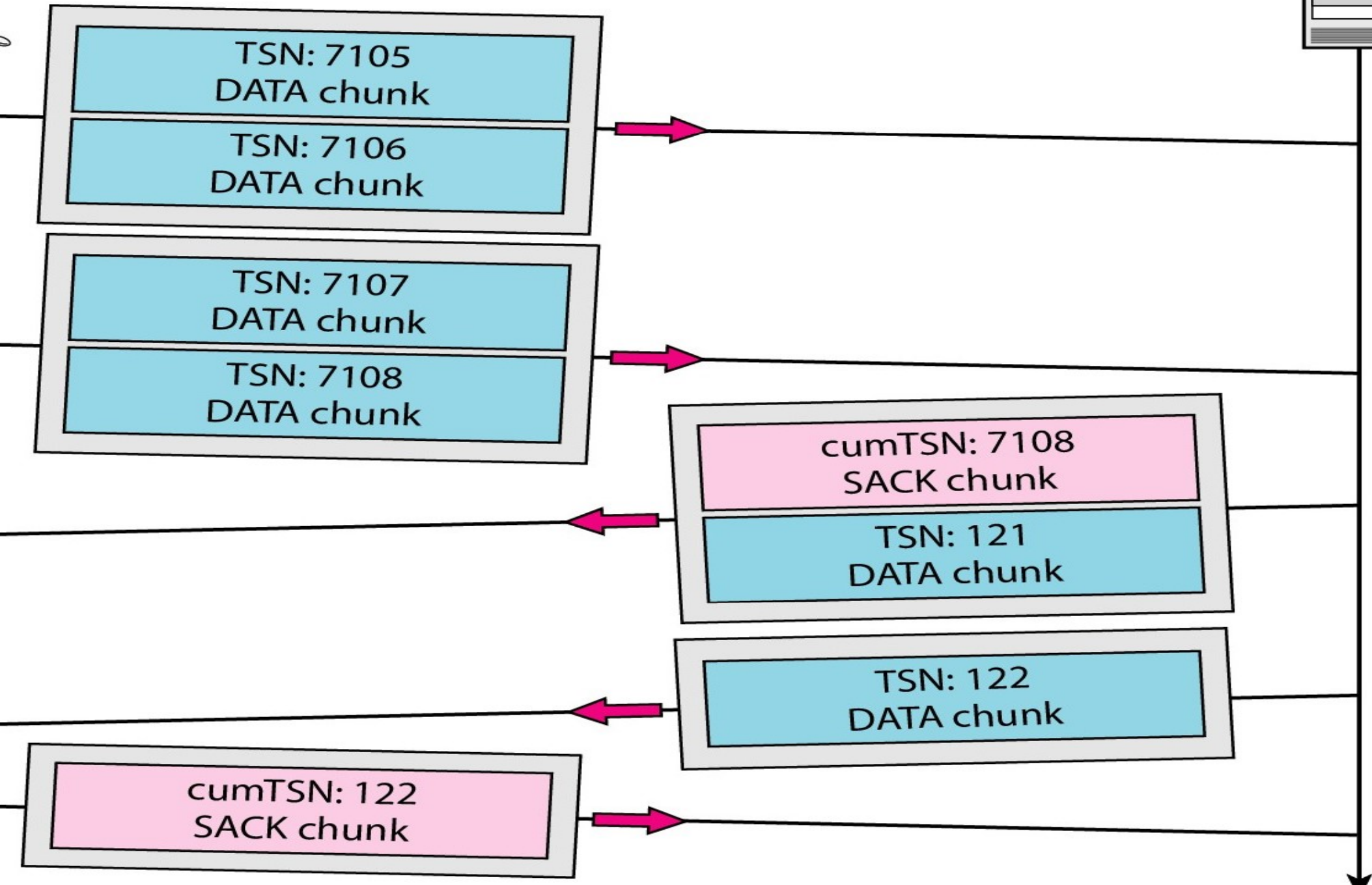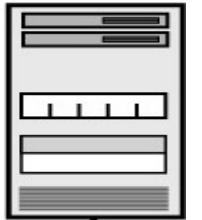| Chunk	Description
DATA	User data
INIT	Sets up an association
INIT ACK	Acknowledges INIT chunk
SACK	Selective acknowledgment
HEARTBEAT	Probes the peer for liveliness
HEARTBEAT ACK	Acknowledges HEARTBEAT
ABORT	Aborts an association
SHUTDOWN	Terminates an association
SHUTDOWN ACK	Acknowledges SHUTDOWN
ERROR	Reports errors without shutdown
COOKIE ECHO	Third packet in association
COOKIE ACK	Acknowledges COOKIE ECHO
SHUTDOWN COMPLETE	Third packet in association

onnection in SCTP is called an association.

other chunk is allowed in a pac

rrying an INIT or INIT ACK chun

COOKIE ECHO or a COOKIE AC

chunk can carry data chunks.

INIT ACK

Cookie

KIE ECHO

Cookie

COOKIE ACK
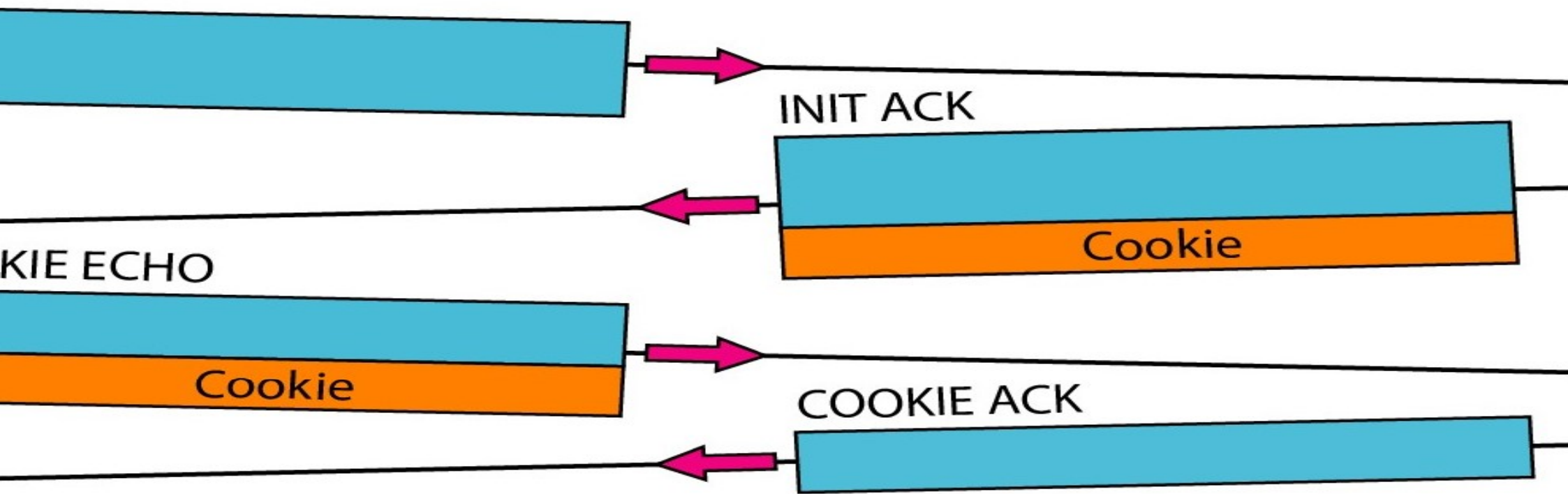
In SCTP, only DATA chunks consume TSNs;
DATA chunks are the only chunks that are acknowledged.

Server

TSN: 7105
DATA chunk

TSN: 7106
DATA chunk

TSN: 7107
DATA chunk

TSN: 7108
DATA chunk

cumTSN: 7108
SACK chunk

TSN: 121
DATA chunk

TSN: 122
DATA chunk

cumTSN: 122
SACK chunk
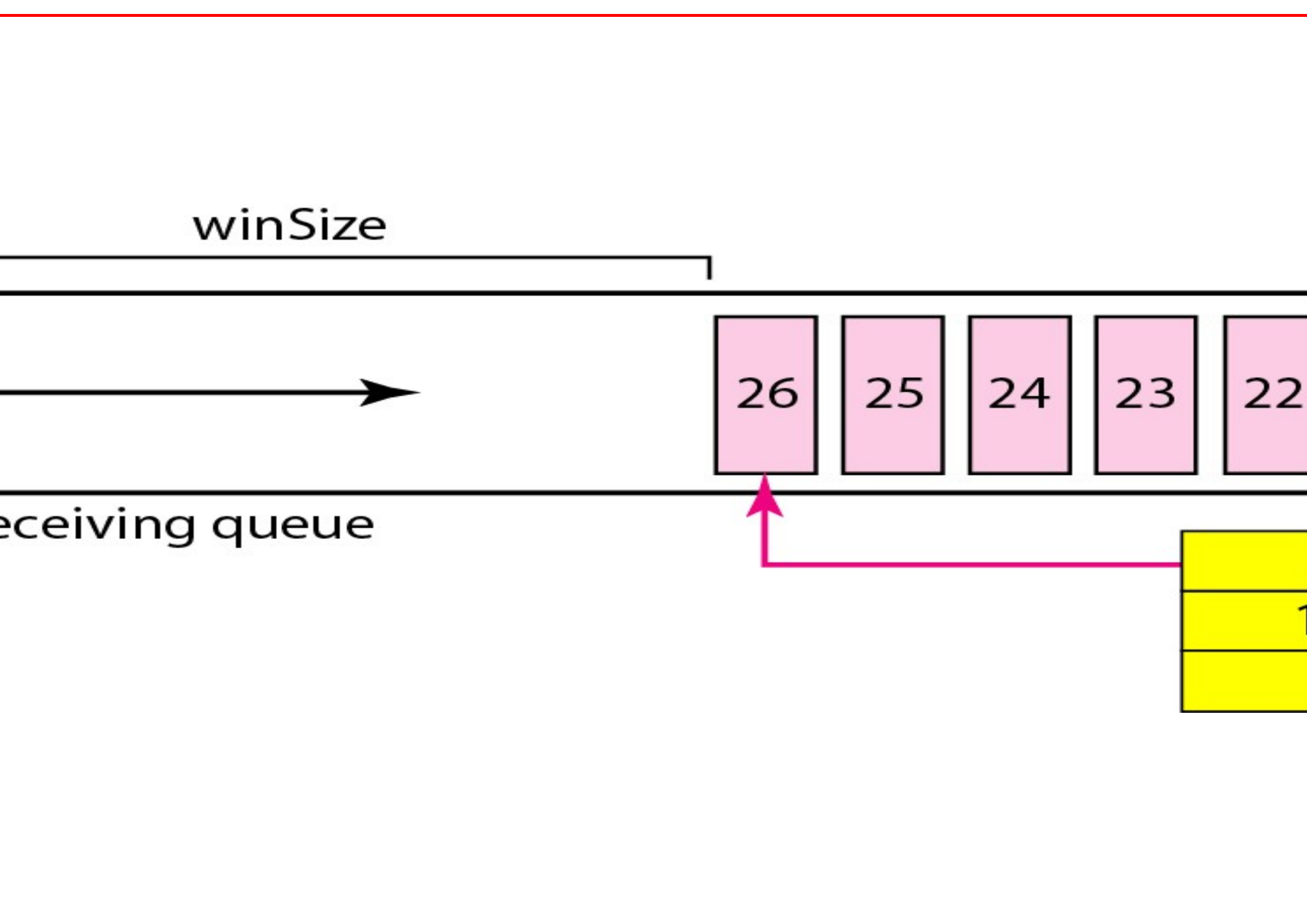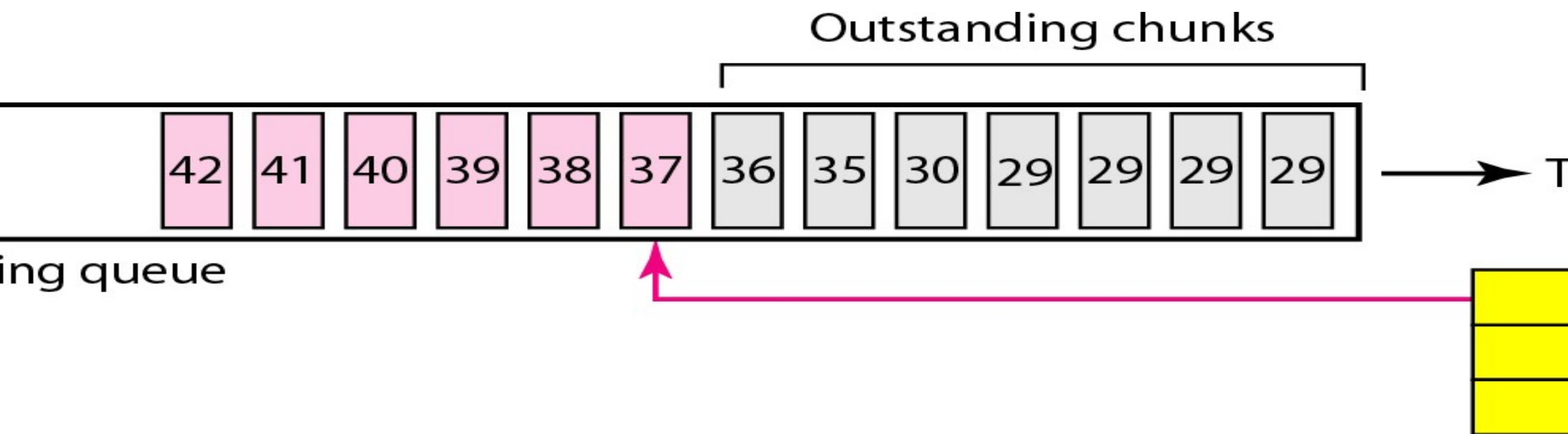
cknowledgment in SCTP defines
ulative TSN, the TSN of the last
chunk received in order.

JTDOWN

cum TSN

SHUTDOWN ACK

JTDOWN
MPLETE

winSize

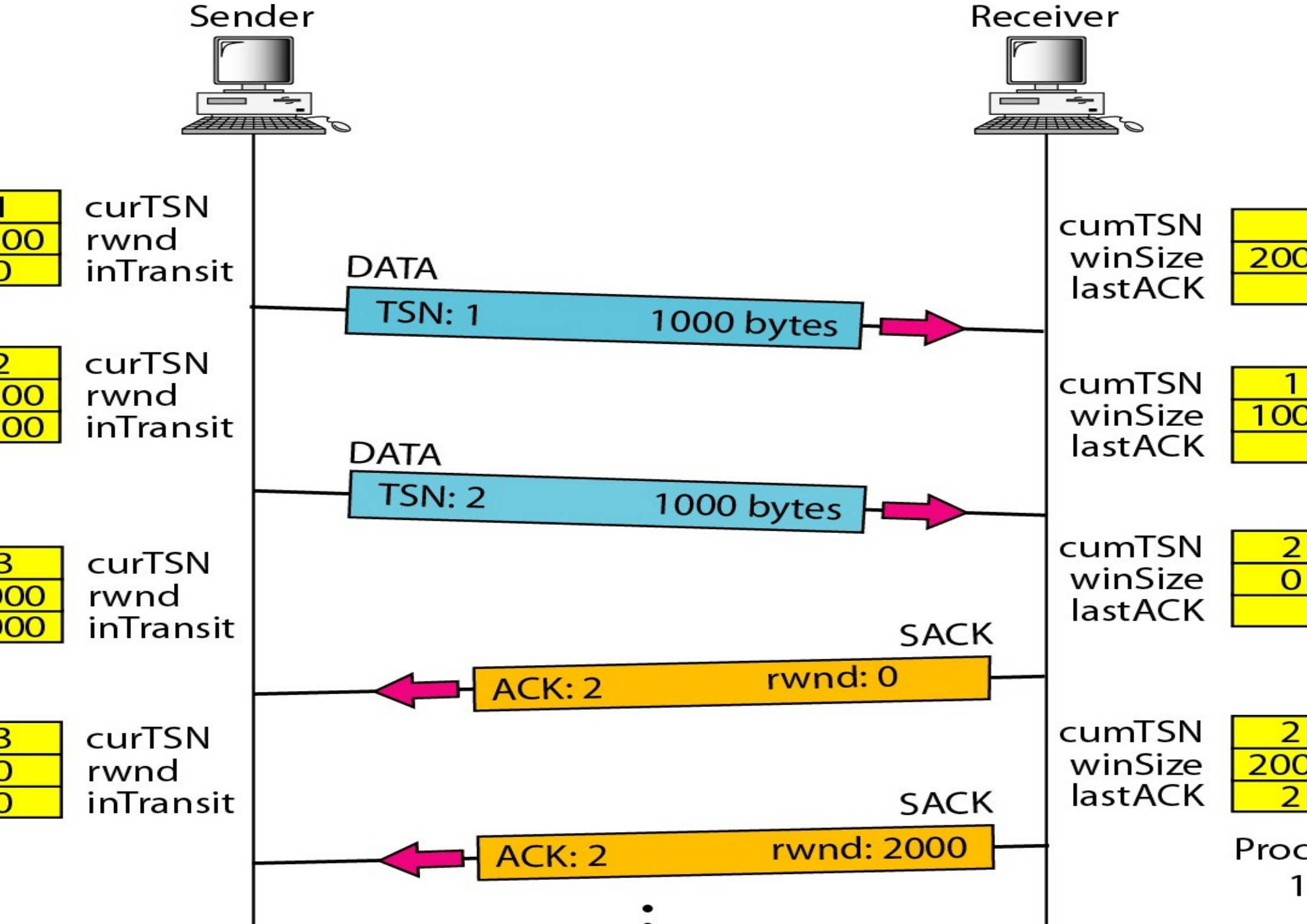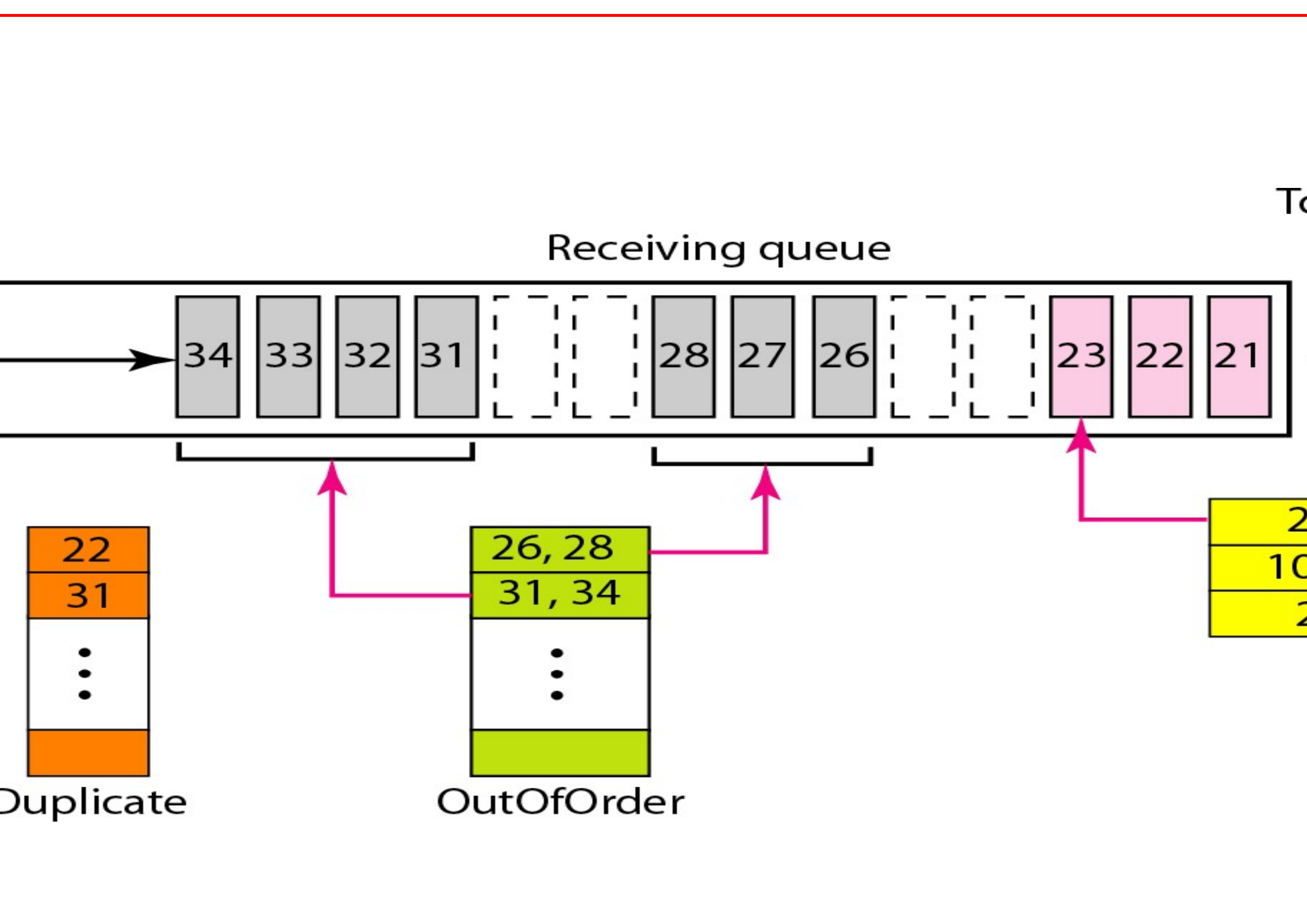26 25 24 23 22

receiving queue

Outstanding chunks

| 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 30 | 29 | 29 | 29 | 29 |

ing queue

Sender

1	curTSN
00	rwnd
0	inTransit

DATA

TSN: 1	1000 bytes

2	curTSN
00	rwnd
00	inTransit

DATA

TSN: 2	1000 bytes

3	curTSN
000	rwnd
000	inTransit

SACK

ACK: 2	rwnd: 0

3	curTSN
0	rwnd
0	inTransit

SACK

ACK: 2	rwnd: 2000

Receiver

cumTSN		
winSize	200	
lastACK		

cumTSN	1	
winSize	100	
lastACK		

cumTSN	2	
winSize	0	
lastACK		

cumTSN	2	
winSize	200	
lastACK	2	

Proc

1

Receiving queue

| 34 | 33 | 32 | 31 | | | 28 | 27 | 26 | | | 23 | 22 | 21 |

To

Duplicate

| 22 |
| 31 |
| ⋮ |

OutOfOrder

| 26, 28 |
| 31, 34 |
| ⋮ |

Outstanding chunks

| 40 | 39 | 38 | 37 | 36 | 35 | ... | 25 | 24 | 23 | → To

ng queue

Add when timer
expires or three
SACKs are received. → | 22 | 21 | → To send
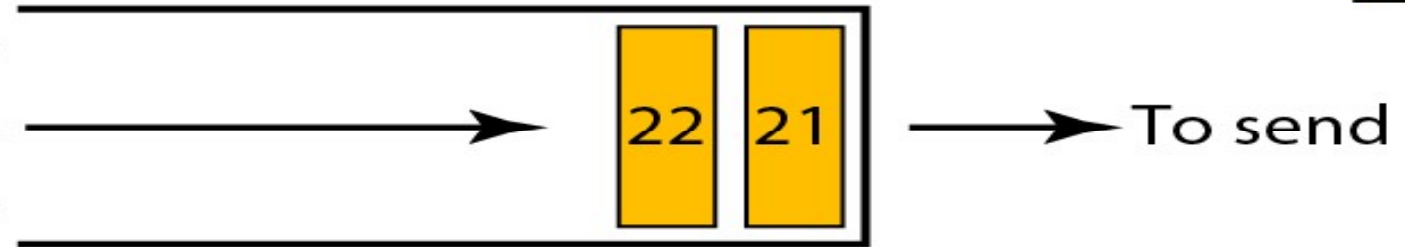
Retransmission
queue

Thank You