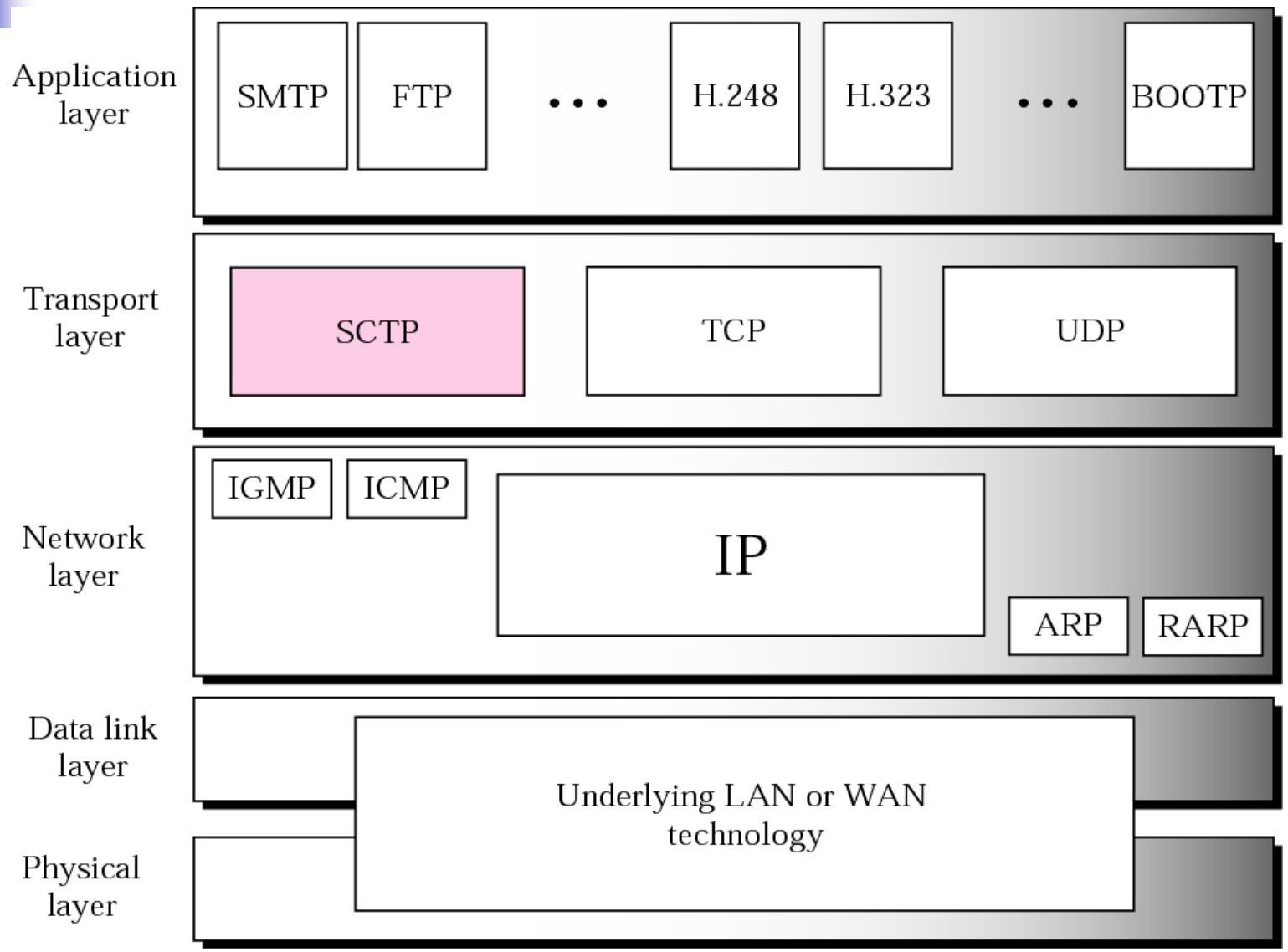
Stream Control Transmission Protocol

Figure 13.1 *TCP/IP protocol suite*



Introduction

- Stream Control Transmission Protocol (SCTP) is a new reliable, message-oriented transport-layer protocol.
- SCTP combines the best features of UDP and TCP.
- SCTP is a reliable message oriented protocol. (UDP)
- It preserves the message boundaries and at the same time detects lost data, duplicate data, and out-of-order data. (TCP)
- It also has congestion control and flow control mechanisms.(TCP)

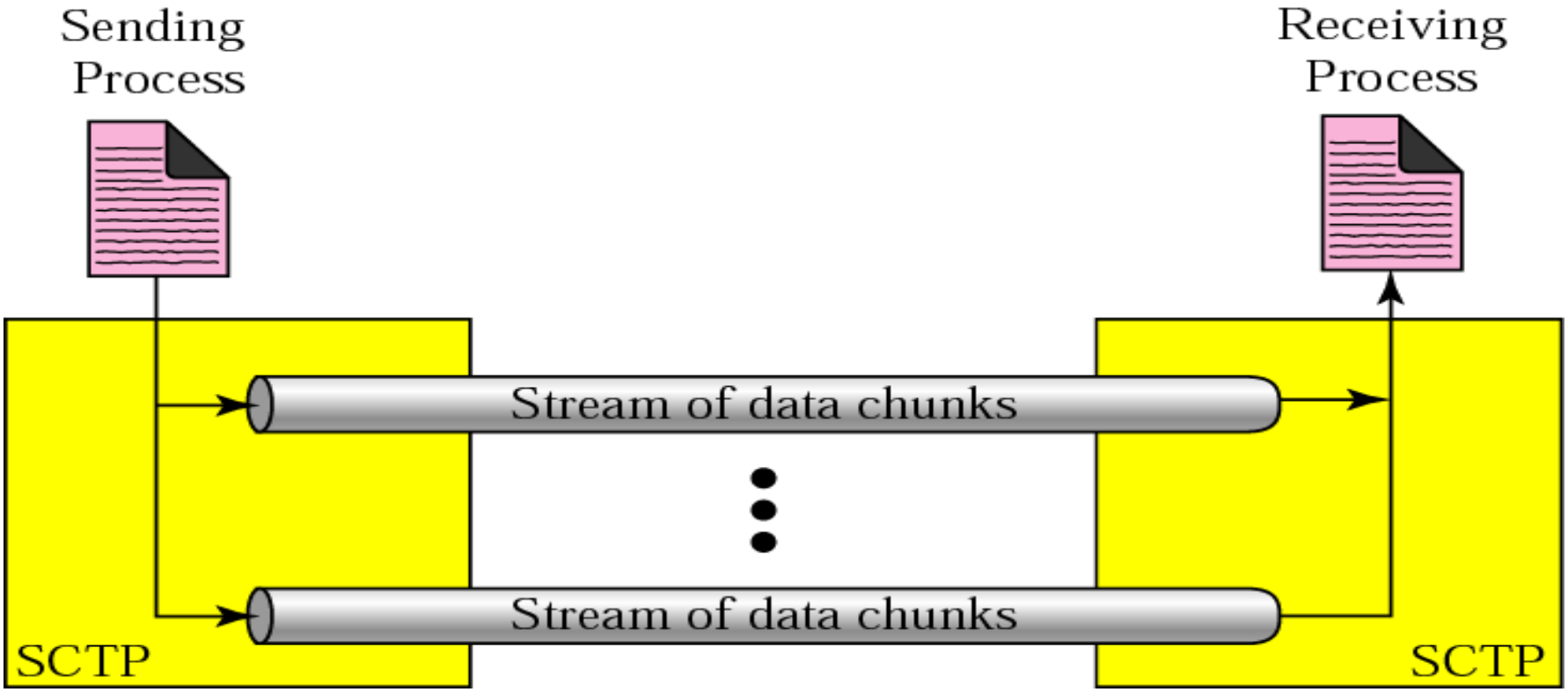
SCTP Services

- Process to process Communication
  - SCTP uses all well known ports in TCP space

Protocol	*Port Number*	*Description*
IUA	9990	ISDN over IP
M2UA	2904	SS7 telephony signalling
M3UA	2905	SS7 telephony signalling
H.248	2945	Media gateway control
H.323	1718, 1719, 1720, 11720	IP telephony
SIP	5060	IP telephony

Figure 13.2 *Multiple-stream concept*

Multiple Streams



Multiple Streams

- SCTP allows **multistream service** in each connection, which is called **association** in SCTP terminology.
- If one of the streams is blocked, the other streams can still deliver their data.

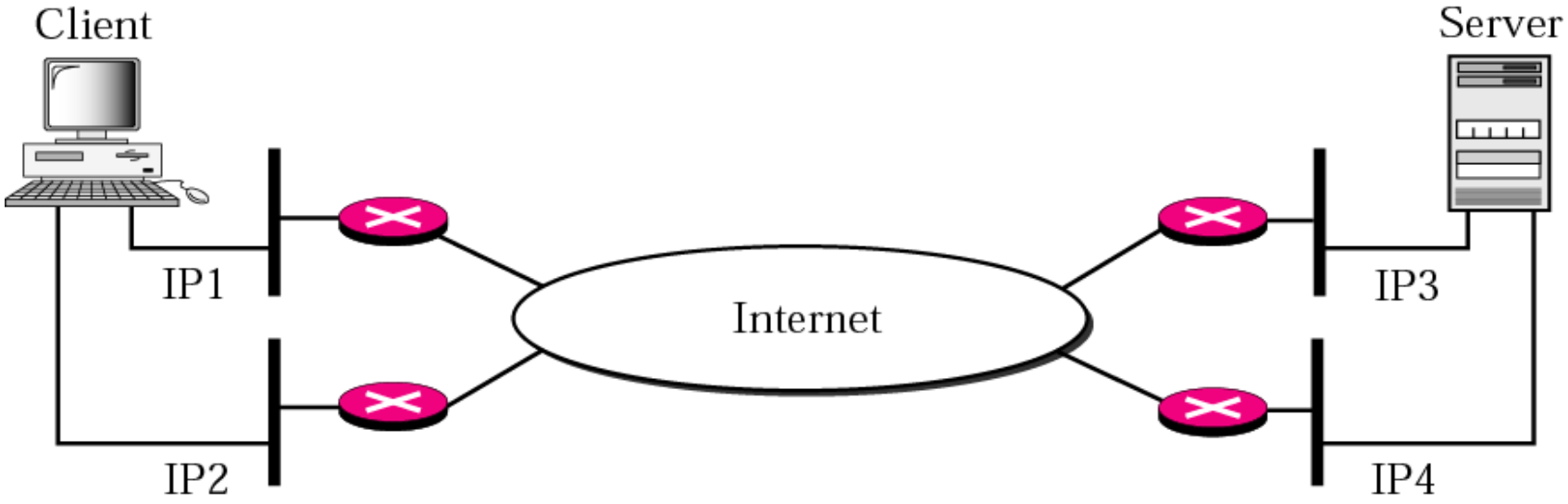
Multihoming

- The sending and receiving host can define multiple IP addresses in each end for an association.
- In this, when one path fails, another interface can be used for data delivery without interruption.
- This fault-tolerant feature is very helpful when we are sending and receiving a real-time payload such as Internet telephony.

Figure 13.3 *Multihoming concept*

Note:

- In current implementation of SCTP, only one pair of IP addresses can be chosen for normal communication; the alternative is used if the main choice fails.
- SCTP does not allow load sharing between different paths.



SCTP Services

- Full Duplex Communication
- Connection oriented
- Reliable Service

SCTP Features

- Transmission Sequence number (TSN)
  - Unit of data in SCTP is Data Chunks
  - SCTP uses TSN to number data chunks.
  - TSN is 32 bit long, randomly initialized between 0 to 2^{32}-1
  - Each data chunk must carry the corresponding TSN in its header

SCTP Features

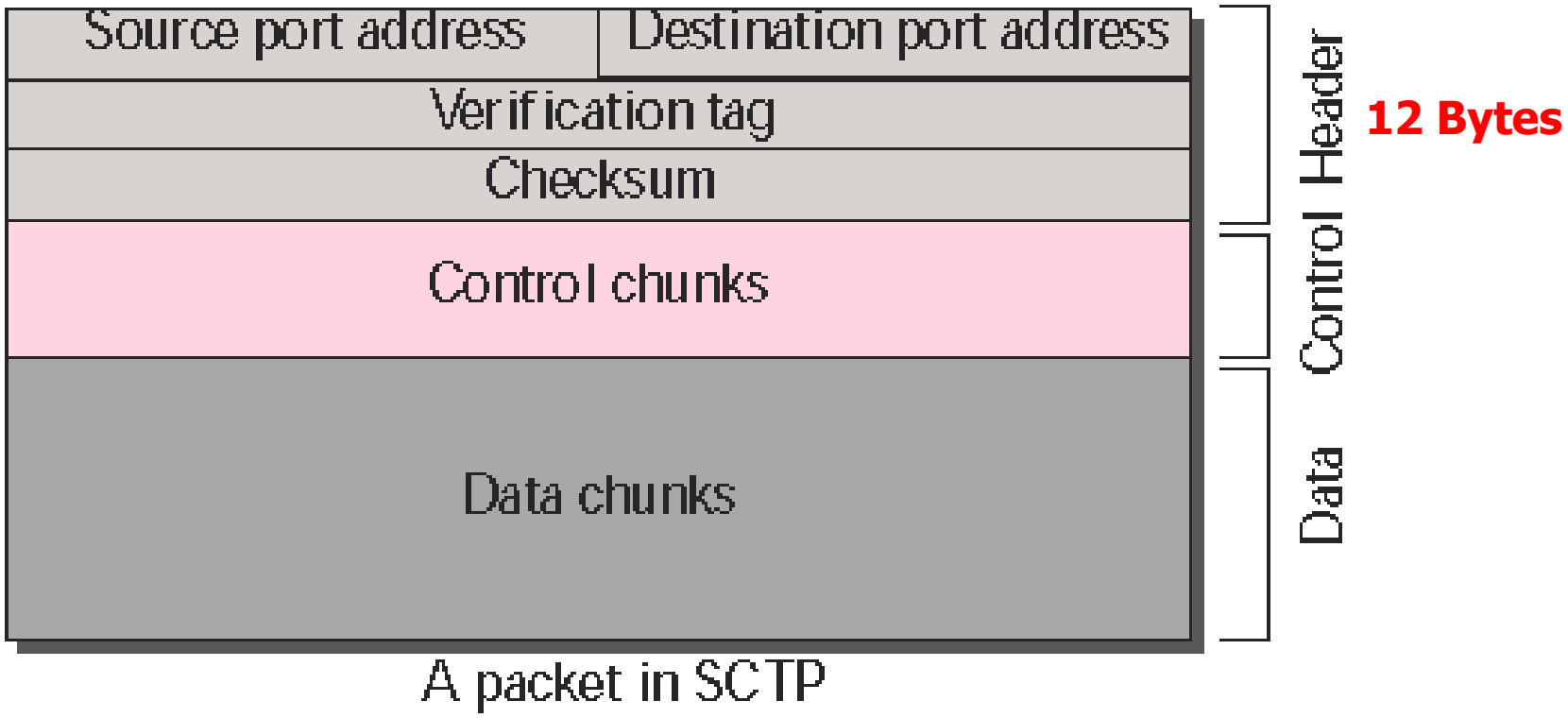
- Stream Identifier (SI)
  - In SCTP, there may be several streams in each association.
  - Each stream in SCTP needs to be identified using a **stream identifier (SI).**
  - **To distinguish between different streams, SCTP uses an SI.**

SCTP Features

- Stream Sequence Number (SSN)
  - To distinguish between different data chunks belonging to the same stream, SCTP uses SSNs.

- Packets
  - In SCTP, data are carried as data chunks, control information as control chunks.
  - Several control chunks and data chunks can be packed together in a packet.
  - **TCP has segments; SCTP has packets.**

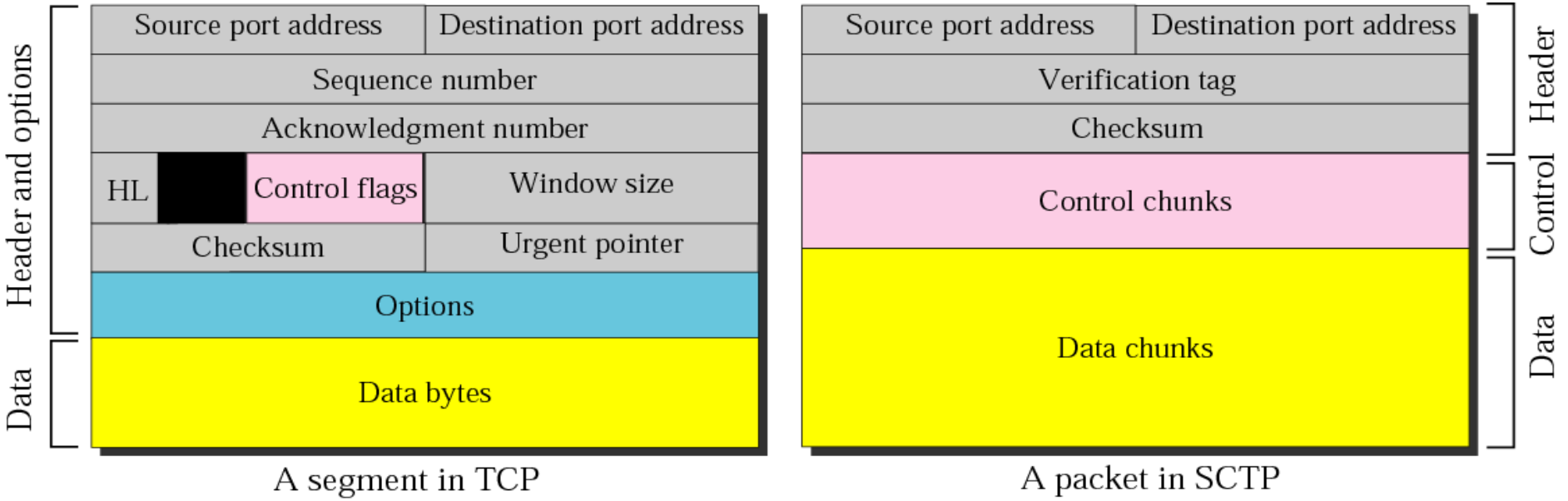
SCTP Packet



A packet in SCTP

- An association may send many packets, a packet may contain several chunks, and chunks may belong to different streams.

Figure 13.4 *Comparison between a TCP segment and an SCTP packet*



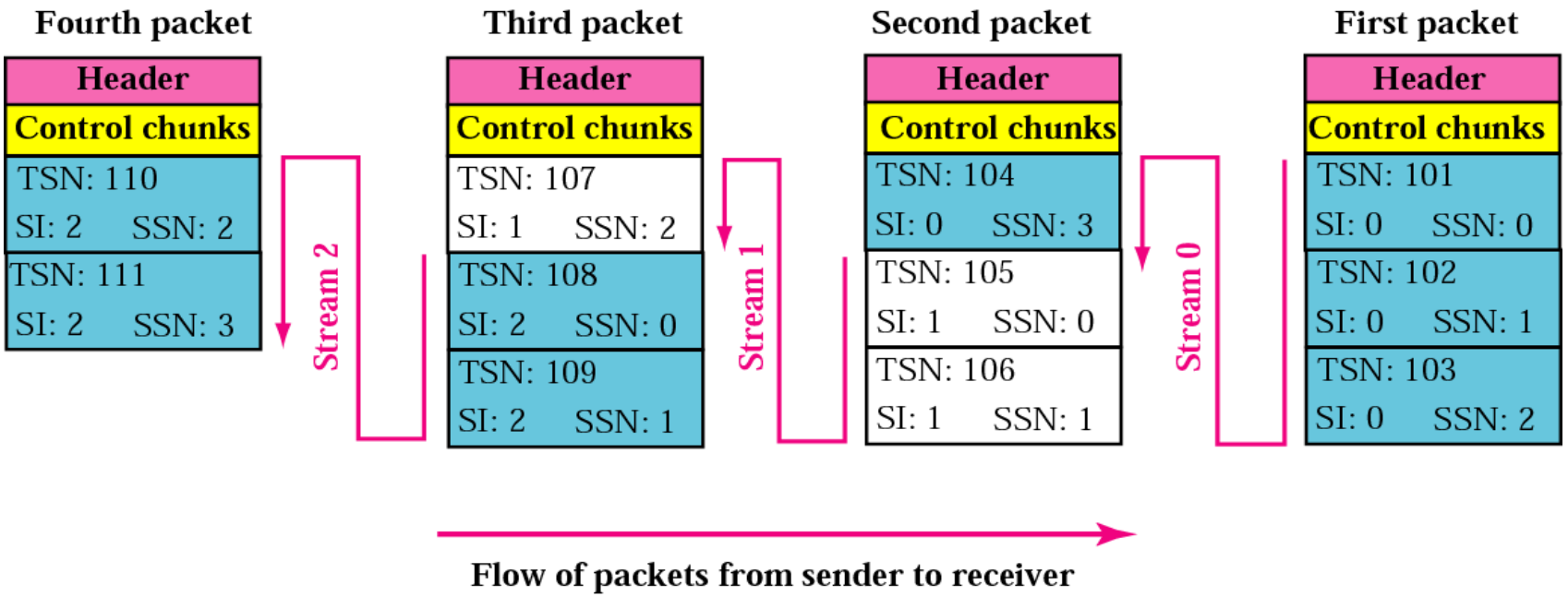
Example

- Process A ----------> Process B

- 11 messages in three streams.
- First four messages are in the first stream, second three messages are in the second stream, last four messages are in the third stream.

- Assume that each message fits into one data chunk.
- Therefore, we have 11 data chunks in three streams.
- only three data chunks per packet - four packets

Figure 13.5 *Packet, data chunks, and streams*



NOTE:

- ***Data chunks are identified by three identifiers: TSN, SI, and SSN.***
- ***TSN is a cumulative number identifying the association;***
- ***SI defines the stream;***
- ***SSN defines the chunk in a stream.***
- ***In SCTP, acknowledgment numbers are used to acknowledge only data chunks;***
- ***Control chunks are acknowledged by other control chunks if necessary.***

SCTP PACKET FORMAT

Figure 13.6 *SCTP packet format*

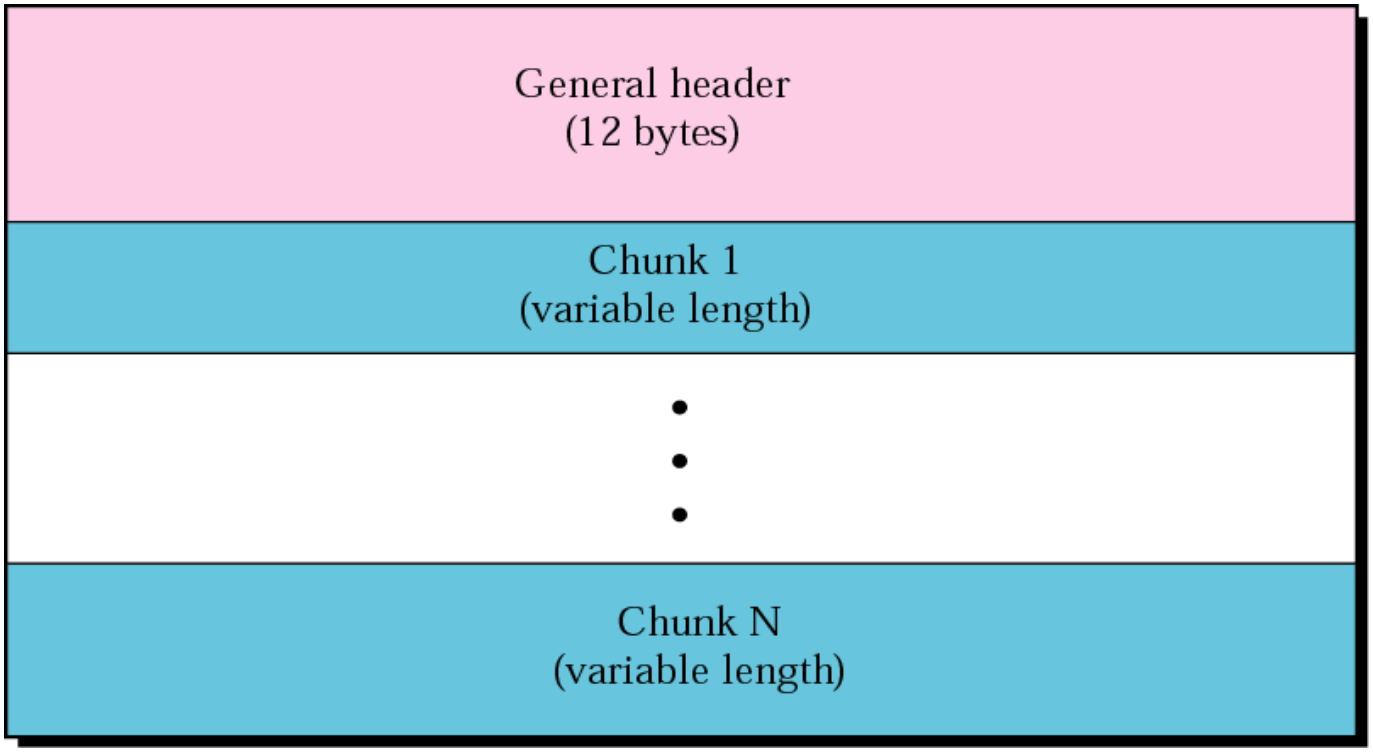
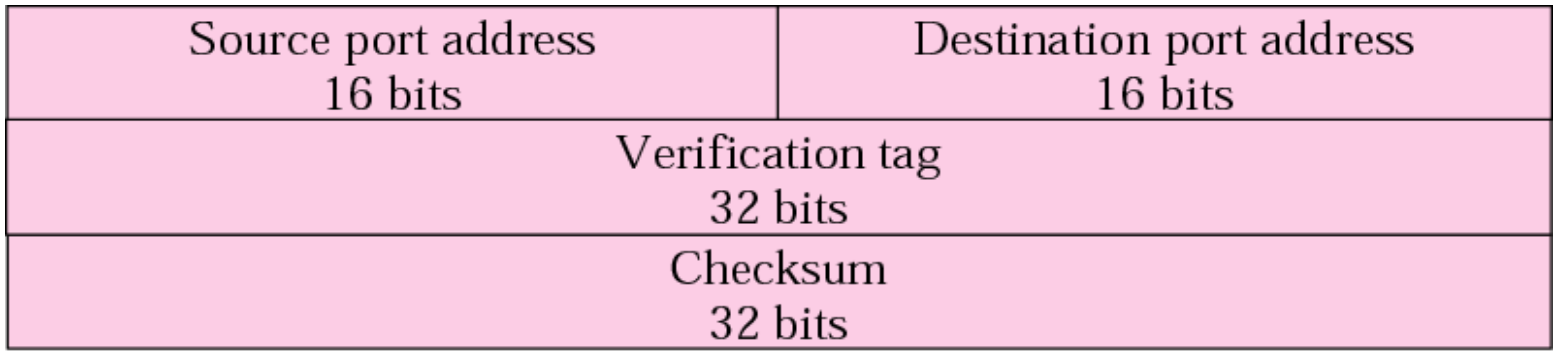


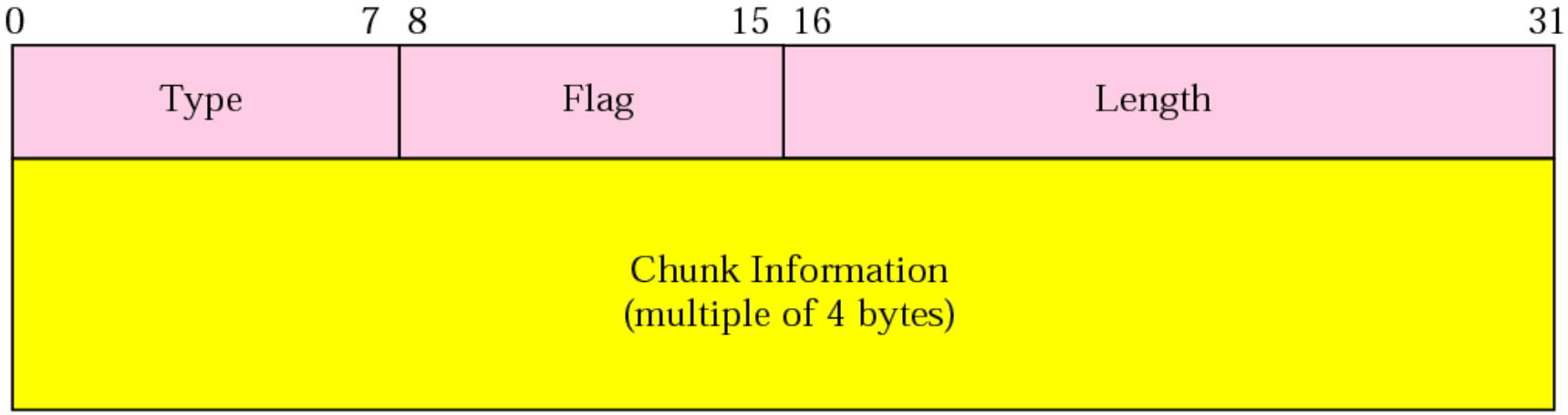
Figure 13.7 *General header*



Verification Tag :

- Number that matches a packet to an association.
- Serves as an identifier for the association and repeated in every packet during association.

Figure 13.8 *Common layout of a chunk*



1. **Type** : Defines 256 types of chunks
2. **Flag :** Defines special flags that a particular chunk may need.
3. **Length :**
   - Total Length of chunk includes Type, Flag and Length.
   - Length of padding not included in calculation
   - If not multiple of 4, receiver knows there is padding.

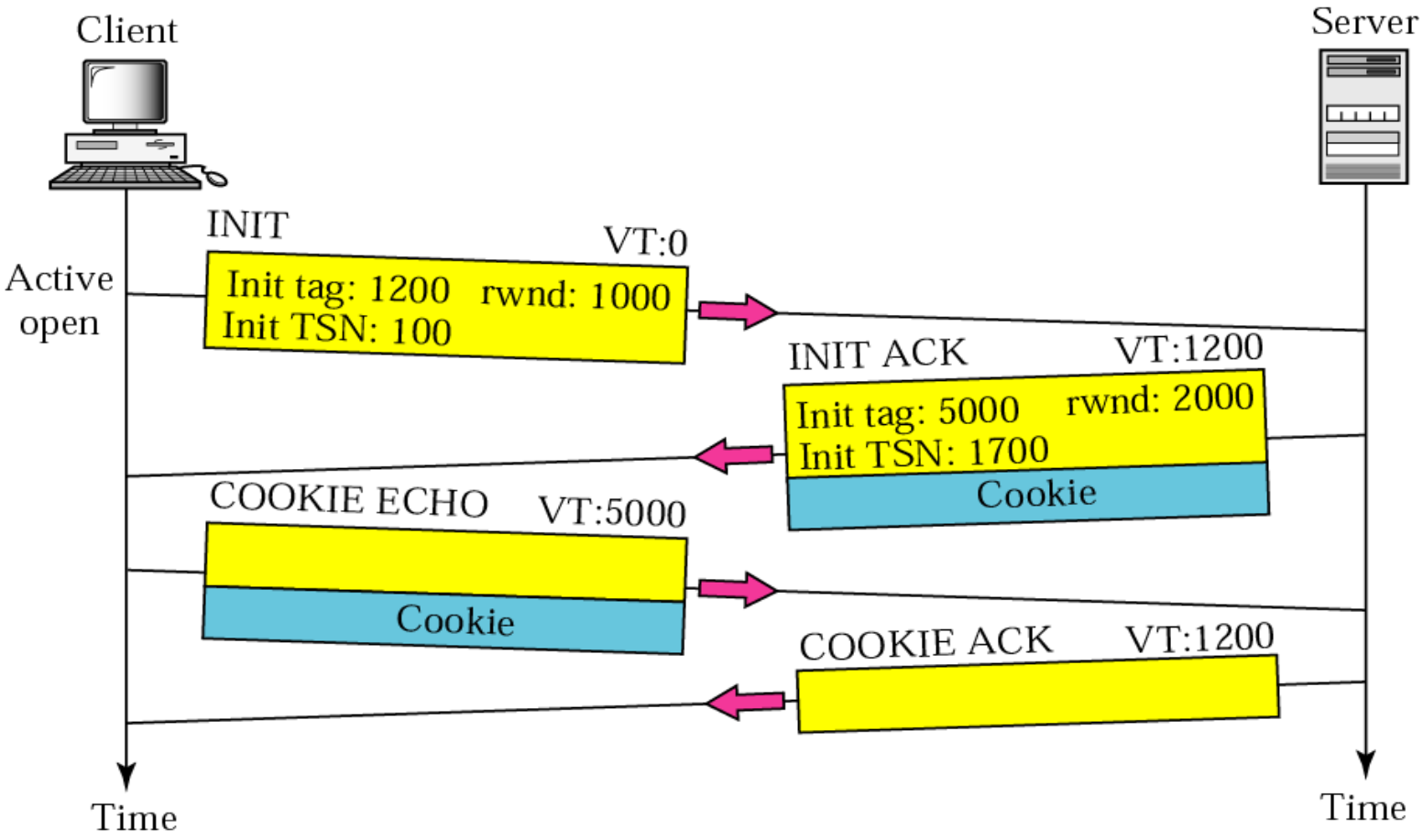
Table 13.2 Chunks

Type	*Chunk*	*Description*
0	**DATA**	User data
1	**INIT**	Sets up an association
2	**INIT ACK**	Acknowledges INIT chunk
3	**SACK**	Selective acknowledgment
4	**HEARTBEAT**	Probes the peer for liveliness
5	**HEARTBEAT ACK**	Acknowledges HEARTBEAT chunk
6	**ABORT**	Abort an association
7	**SHUTDOWN**	Terminates an association
8	**SHUTDOWN ACK**	Acknowledges SHUTDOWN chunk
9	**ERROR**	Reports errors without shutting down
10	**COOKIE ECHO**	Third packet in association establishment
11	**COOKIE ACK**	Acknowledges COOKIE ECHO chunk
14	**SHUTDOWN COMPLETE**	Third packet in association termination
192	**FORWARD TSN**	For adjusting cummulating TSN

AN SCTP ASSOCIATION

Figure 13.19 *Four-way handshaking*

Association Establishment :



Cookie carry state of server

NOTE:

- ***No other chunk is allowed in a packet carrying an INIT or INIT ACK chunk.***
- ***A COOKIE ECHO or a COOKIE ACK chunk can carry DATA chunks.***
- ***In SCTP, only DATA chunks consume TSNs;***
- ***DATA chunks are the only chunks that are acknowledged.***

Figure 13.20 *Simple data transfer*

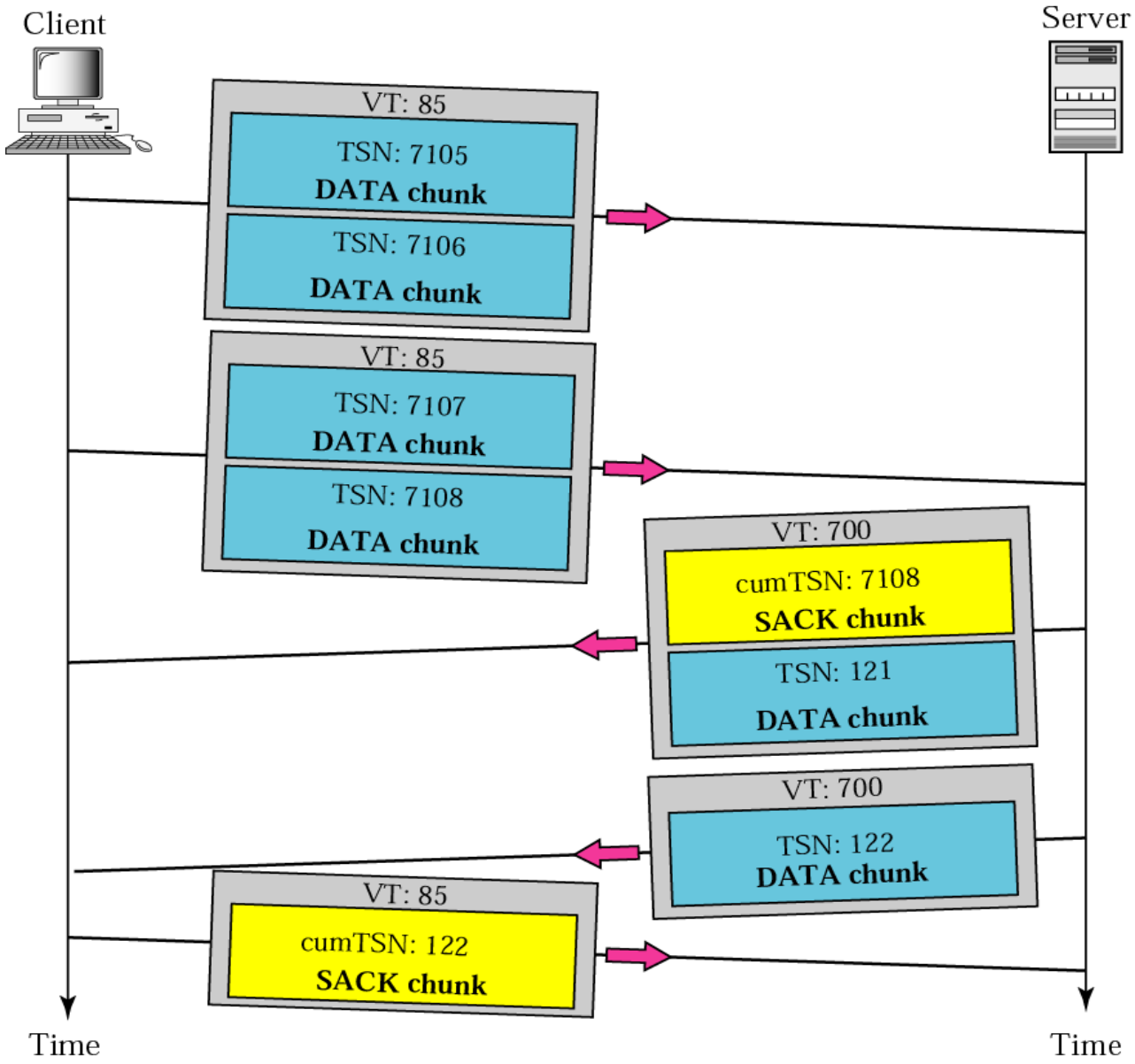


Figure 13.21 *Association termination*