SNS COLLEGE OF ENGINEERING

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE NAME :19IT401 COMPUTER NETWORKS

II YEAR /IV SEMESTER

Unit 3-**Network layer**

Topic 4 : IP datagram

IP : datagram

The **Internet Protocol** (**IP**) is a set of requirements for addressing and routing data on the Internet.

A **datagram** is a basic transfer unit associated with a packet-switched **network**.
Datagrams are typically structured in header and payload sections.
Datagrams provide a connectionless communication service across a packet-switched **network**.

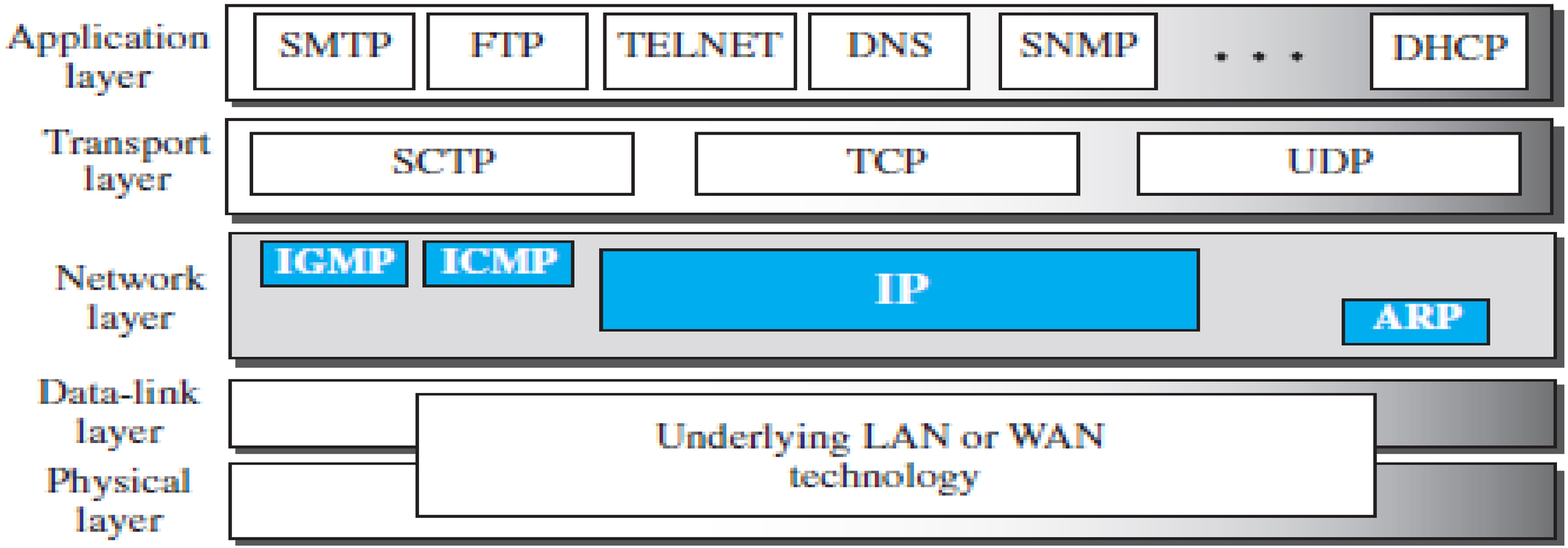
INTERNET PROTOCOL

1. The internetworking protocol is the transmission mechanism used by TCP/IP Protocol.
2. It is unreliable and connectionless datagram protocol.
3. The IP provides no error checking or tracking.
4. IP assumes the unreliability of the underlying layer and does its best to get a transmission through its destination, but with no guarantee.
5. IP transports data in Packets called datagrams , each of which transported separately.
6. Datagrams can travel along different routes and can arrive out of sequence or be duplicated.
7. IP does not keep track of the routes and has no facility for reordering datagrams once they arrive at their destination.

Internet Protocol

1. The main protocol, Internet Protocol version 4 (IPv4), is responsible for packetizing, forwarding, and delivery of a packet at the network layer.
2. The Internet Control Message Protocol version 4 (ICMPv4) helps IPv4 to handle some errors that may occur in the network-layer delivery.
3. The Internet Group Management Protocol (IGMP) is used to help IPv4 in multicasting.
4. The Address Resolution Protocol (ARP) is used to glue the network and data-link layers in mapping network-layer addresses to link-layer addresses.

Figure 19.1 *Position of IP and other network-layer protocols in TCP/IP protocol suite*

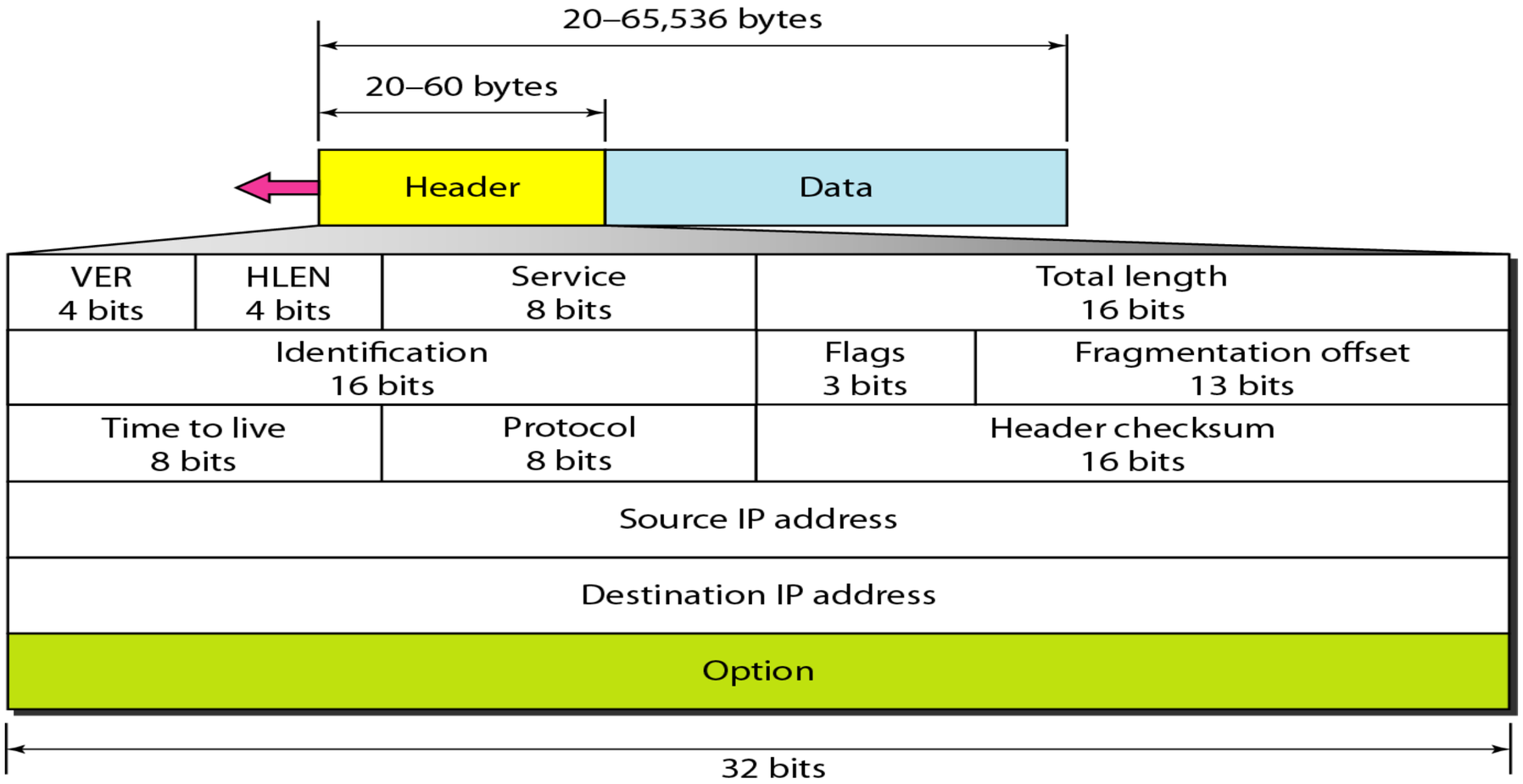


Stream Control Transmission Protocol (**SCTP**) is a transport-layer protocol that can be used on top of IP networks for end-to-end communications.

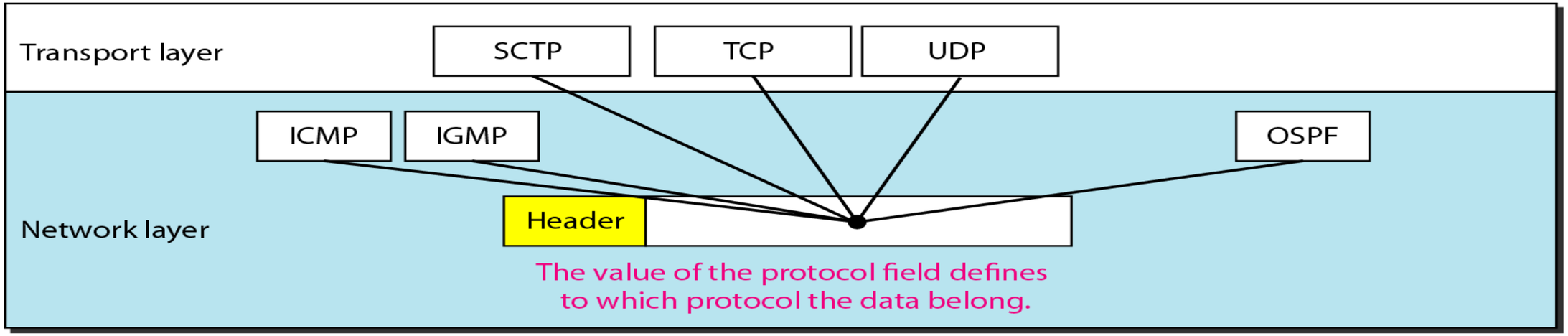
IPv4 datagram format

1. *Version Number. The 4-bit version (VER) field defines the version of the* IPv4 protocol, value is 4.
2. *Header Length. The 4-bit header length (HLEN) field defines the total length of* the datagram header in 4-byte words. The IPv4 datagram has a variable-length header.
3. *Service Type. In the original design of the IP header, this field was referred to as* type of service (TOS), which defined how the datagram should be handled.
4. *Total Length. This 16-bit field defines the total length (header plus data) of the IP* datagram in bytes.
5. *Identification, Flags, and Fragmentation Offset. These three fields are related to* the fragmentation of the IP datagram when the size of the datagram is larger than the underlying network can carry
6. The time-to-live (TTL) field is used to control the maximum number of hops (routers) visited by the datagram
7. *Options.* used for network testing and debugging.
8. *Header checksum. To check errors in the header*
9. Protocol: When the payload is encapsulated in a datagram at the source IP, the corresponding protocol number is inserted in this field; when the datagram arrives at the destination, the value of this field helps to define to which protocol the payload should be delivered.

IPv4 datagram format



Protocol field and encapsulated data

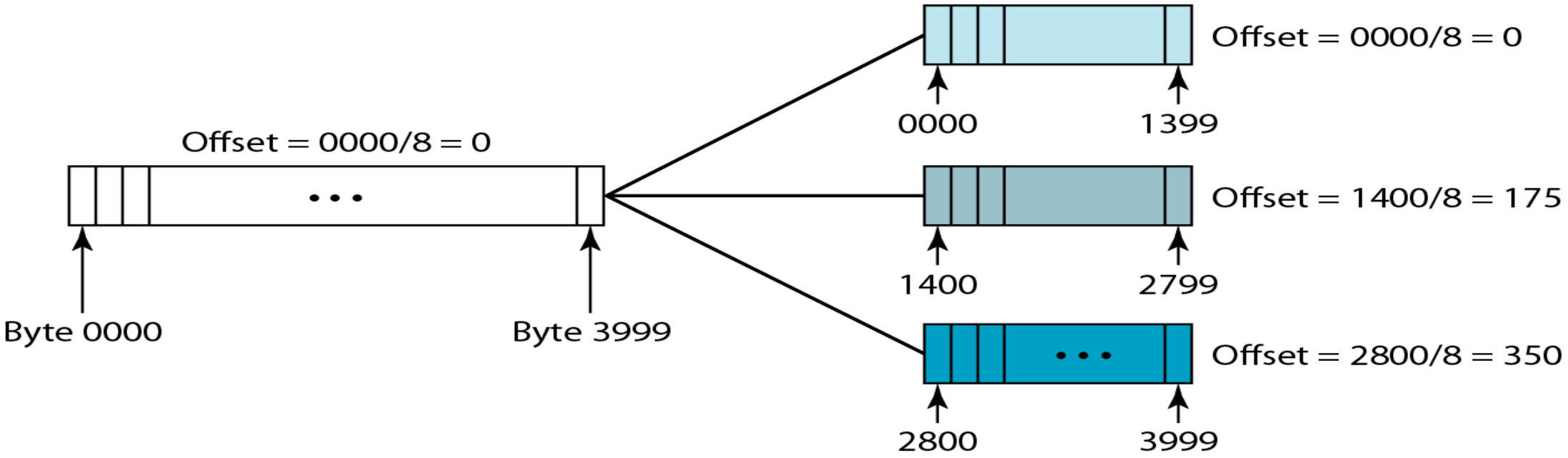


Open Shortest Path First
Internet Group Management Protocol
Internet Control Message Protocol

Protocol values

Value	*Protocol*
1	ICMP
2	IGMP
6	TCP
17	UDP
89	OSPF

Fragmentation example



fragmentation

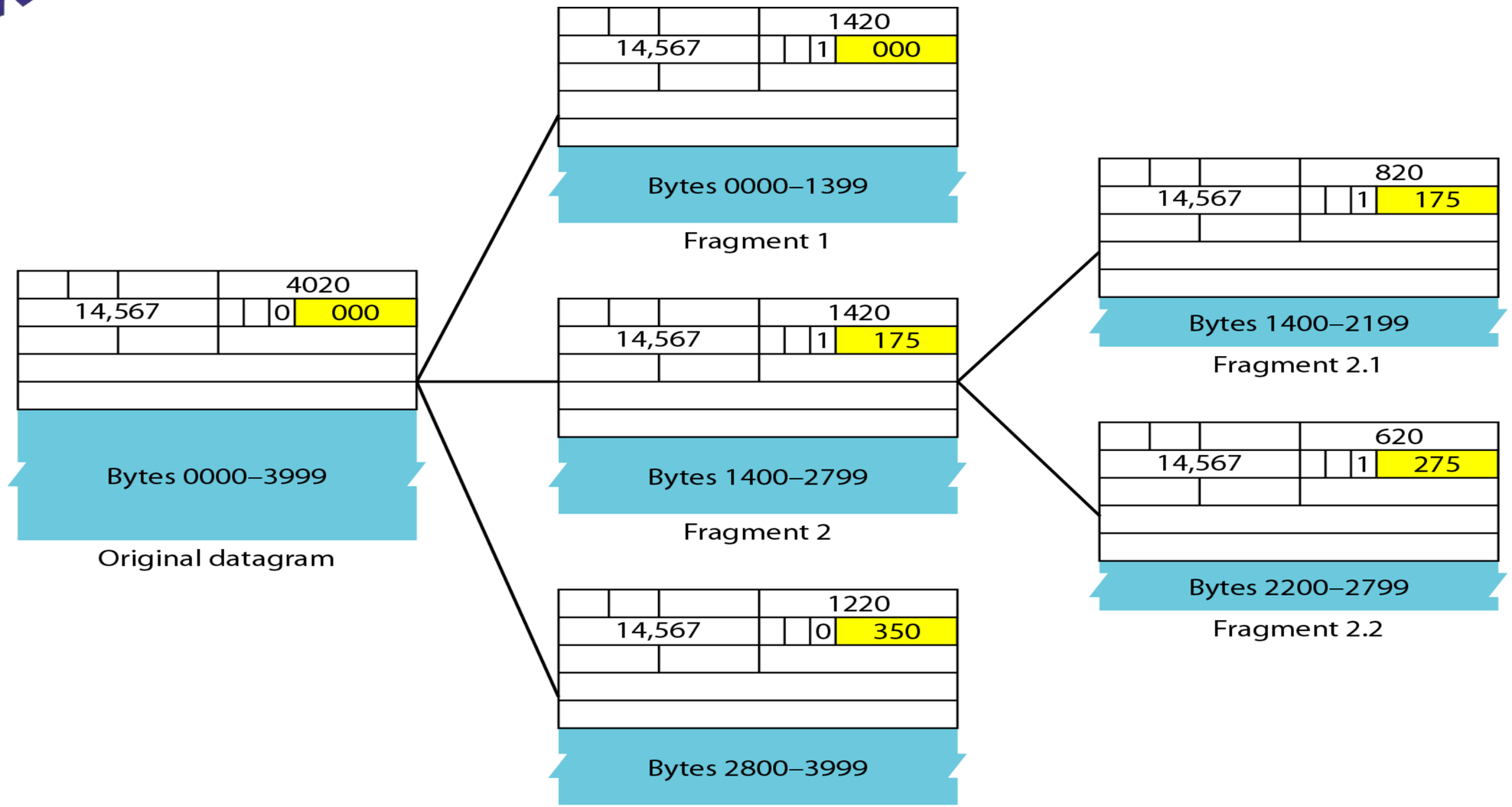
Figure shows a datagram with a data size of 4000 bytes fragmented into three fragments.

The bytes in the original datagram are numbered 0 to 3999. The first fragment carries bytes 0 to 1399. The offset for this datagram is 0/8 = 0.

The second fragment carries bytes 1400 to 2799; the offset value for this fragment is 1400/8 = 175.

Finally, the third fragment carries bytes 2800 to 3999. The offset value for this fragment is 2800/8 = 350.

Detailed fragmentation example



Assessment

a) List Network layer protocols.
 b) What is IP?
c) What is fragmentation?
d) What is UDP?.

Reference

TEXT BOOKS

Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

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