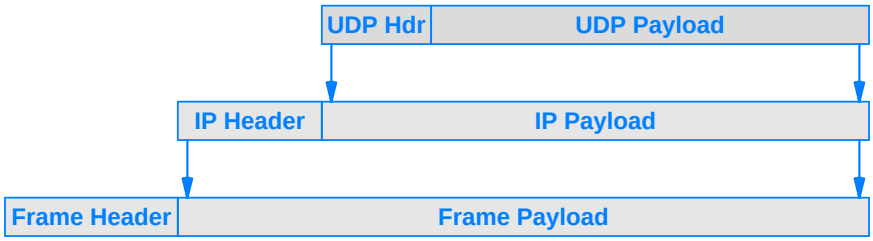

Figure 24.3 The encapsulation of a UDP message in an IP datagram.

24.12 Summary

The User Datagram Protocol (UDP) provides connectionless end-to-end message transport from an application running on one computer to an application running on another computer. UDP offers the same best-effort delivery semantics as IP, which means that messages can be lost, duplicated, or delivered out-of-order. One advantage of a connectionless approach arises from the ability to have 1-to-1, 1-to-many, and many-to-1 interactions among applications.

To remain independent of the underlying operating systems, UDP uses small integer protocol port numbers to distinguish among application programs. Protocol software on a given computer must map each protocol port number to the appropriate mechanism (e.g., process ID) used on the computer.

The UDP checksum is optional — if a sender fills the checksum field with zero, the receiver does not verify the checksum. To verify that the UDP datagram arrived at the correct location, a UDP checksum is computed over the datagram plus a pseudo header.

UDP requires two levels of encapsulation. Each UDP message is encapsulated in an IP datagram for transmission across the Internet. The datagram is encapsulated in a frame for transmission across an individual network.

EXERCISES

24.1 What is the conceptual difference between IP and end-to-end protocols?

24.2 List the features of UDP.

24.3 Do applications need to exchange UDP control messages before exchanging data? Explain.

24.4 Calculate the size of the largest possible UDP message when using IPv4 and IPv6. (Hint: the entire UDP message must fit in an IP datagram.)