Module 7

Internet And Internet Protocol Suite

Lesson

25

UDP. protocol suite

LESSON OBJECTIVE

General

The lesson will discuss the connectionless transport layer protocol, i.e. the User Datagram Protocol.

Specific

The focus areas of this lesson are:

1. idea of UDP
2. complete TCP/IP protocol suite

7.5.1 UDP

In addition to TCP, there is one other transport-level protocol that is in common use as part of the TCP/IP protocol suite: the User datagram protocol (UDP).

The User Datagram Protocol (UDP) supports network applications that need to transport data between computers. Applications that use UDP include client/server programs like video conferencing systems. Although UDP has been in use for many years -- and overshadowed by more glamorous alternatives -- it remains an interesting and viable technology.

UDP -- like its cousin the Transmission Control Protocol (TCP) -- sits directly on top of the base Internet Protocol (IP).

In general, UDP implements a fairly "lightweight" layer above the Internet Protocol. UDP's main purpose is to abstract network traffic in the form of *datagrams*. A datagram comprises one single "unit" of binary data; the first eight (8) bytes of a datagram contain the *header information* and the remaining bytes contain the data itself.

UDP provides a way for applications to send encapsulated raw IP datagrams and send them without having to establish a connection. Many client-server applications that have one request and one res0ponse use UDP rather than go to the trouble of establishing and releasing a connection. UDP sits on top of IP. Because it is connectionless, UDP has very little to do. It adds a port addressing capability to IP

UDP segment consists of the 8 byte header followed by the data.

UDP Headers

The UDP header consists of four (4) fields of two bytes each:

- source port number

- destination port number
- datagram size (length)
- checksum

UDP port numbers allow different applications to maintain their own "channels" for data; both UDP and TCP use this mechanism to support multiple applications sending and receiving data concurrently. The sending application (that could be a client or a server) sends UDP datagrams through the source port, and the recipient of the packet accepts this datagram through the destination port. Some applications use *static port numbers* that are reserved for or registered to the application. Other applications use *dynamic* (unregistered) *port numbers*. Because the UDP port headers are two bytes long, valid port numbers range from 0 to 65535; by convention, values above 49151 represent dynamic ports.

The UDP *datagram size* is a simple count of the number of bytes contained in the header and data sections. Because the header length is a fixed size, this field essentially refers to the length of the variable-sized data portion (sometimes called the *payload*). The maximum size of a datagram varies depending on the operating environment. With a two-byte size field, the theoretical maximum size is 65535 bytes. However, some implementations of UDP restrict the datagram to a smaller number -- sometimes as low as 8192 bytes.

UDP *checksums* work as a safety feature. The checksum value represents an encoding of the datagram data that is calculated first by the sender and later by the receiver. Should an individual datagram be tampered with (due to a hacker) or get corrupted during transmission (due to line noise, for example), the calculations of the sender and receiver will not match, and the UDP protocol will detect this error. The algorithm is not fool-proof, but it is effective in many cases. In UDP, checksumming is optional -- turning it off squeezes a little extra performance from the system -- as opposed to TCP where checksums are mandatory.

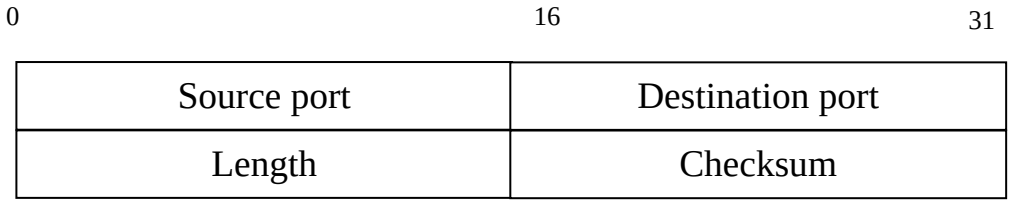


Figure 1 UDP header

The primary difference between UDP and TCP lies in their respective implementations of reliable messaging. TCP includes support for *guaranteed delivery*, meaning that the recipient automatically acknowledges the sender when a message is received, and the sender waits and retries in cases where the receiver does not respond in a timely way.

UDP, on the other hand, does not implement guaranteed message delivery. A UDP datagram can get "lost" on the way from sender to receiver, and the protocol itself does nothing to detect or report this condition. UDP is sometimes called an *unreliable transport* for this reason.

Another way in which UDP works unreliably is in the receipt of a *burst* of multiple datagrams. Unlike TCP, UDP provides no guarantees that the order of delivery is preserved.

On the surface, an "unreliable" network protocol may not seem very worthwhile or desirable. But in fact, UDP can be very useful in certain situations, and it enjoys one key advantage over TCP -- speed. The reliability features built into TCP can be expensive in terms of overhead at execution time. Also note that UDP does not preclude reliable message delivery, it merely defers those details to a higher level of the network stack.

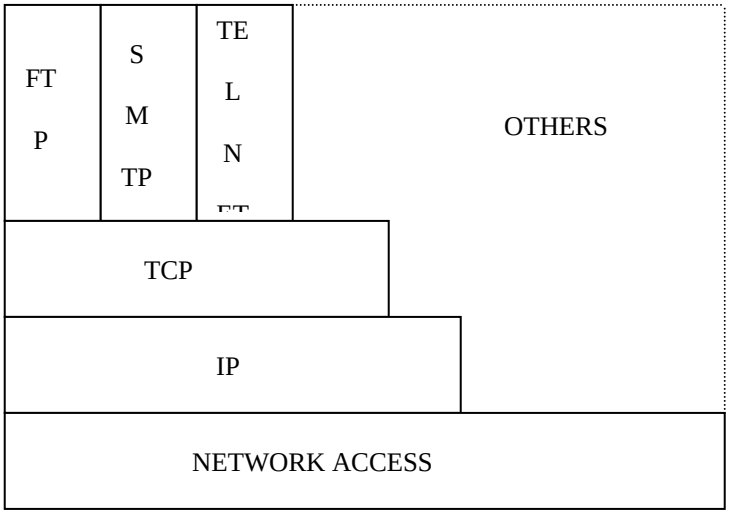
7.5.2 THE PROTOCOL SUITE

Apart from TCP, the DOD also introduced a few other transport layer protocols such as

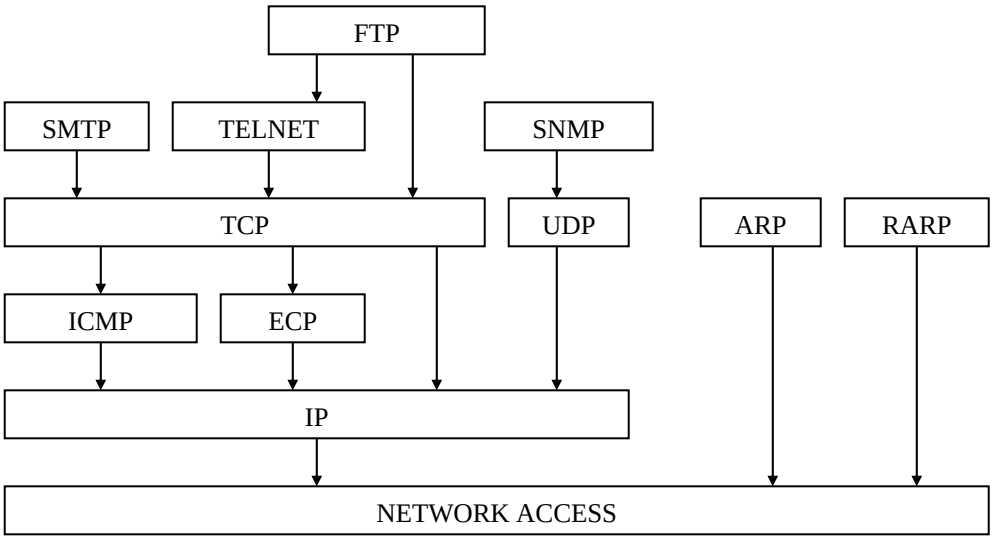
- TELNET: A terminal emulation program for TCP/IP networks such as the Internet. The Telnet program runs on a computer and connects it to a server on the network. Commands can then be entered through the Telnet program and they will be executed as if they were being

entered directly on the server console. This enables one to control the server and communicate with other servers on the network.

- FTP: used for exchanging files over the Internet. FTP works in the same way as HTTP for transferring Web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer.
- SMTP: used for sending e-mail messages between servers. Most e-mail systems that send mail over the Internet use SMTP to send messages from one server to another; the messages can then be retrieved with an e-mail client using either POP or IMAP. In addition, SMTP is generally used to send messages from a mail client to a mail server.
- SFTP:



The Relation Of These Protocols To Each Other And To TCP/IP Is As Shown Below



Objective Questions

25.01 UDP is a _____ protocol.

25.02 UDP header is _____bytes long

Subjective Questions

25.11

Level 2 Questions

25.21