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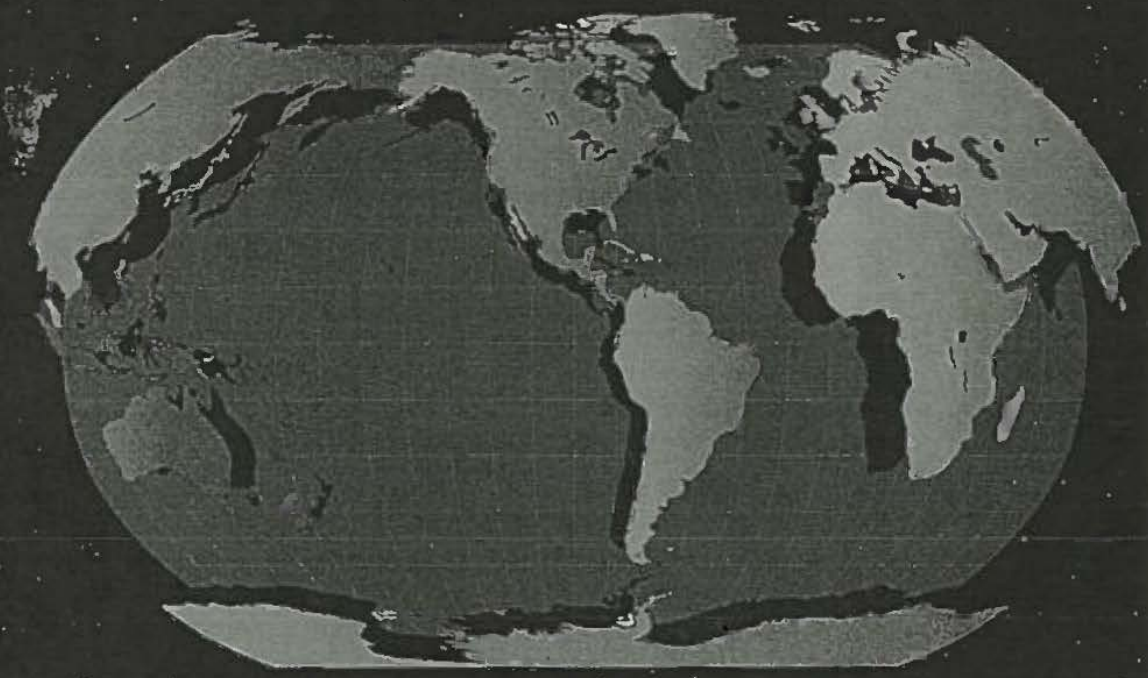
INTERNETWORKING WITH TCP/IP

VOLUME I
PRINCIPLES, PROTOCOLS, AND ARCHITECTURE



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25

Applications: Electronic Mail (822, SMTP, MIME)

25.1 Introduction

This chapter continues our exploration of internetworking by considering electronic mail service and the protocols that support it. The chapter describes how a mail system is organized, explains alias expansion, and shows how mail system software uses the client-server paradigm to transfer each message.

25.2 Electronic Mail

Many users first encounter computer networks when they send or receive electronic mail (e-mail) to or from a remote site. E-mail is the most widely used application service. Indeed, many computer users access networks only through electronic mail.

E-mail is popular because it offers a fast, convenient method of transferring information. E-mail can accommodate small notes or large voluminous memos with a single mechanism. It should not surprise you to learn that more users send files with electronic mail than with file transfer protocols.

Mail delivery is a new concept because it differs fundamentally from other uses of networks that we have discussed. In all our examples, network protocols send packets directly to destinations, using timeout and retransmission for individual segments if no acknowledgement returns. In the case of electronic mail, however, the system must provide for instances when the remote machine or the network connections have failed. A sender does not want to wait for the remote machine to become available before con-

tinuing work, nor does the user want the transfer to abort merely because communication with the remote machine becomes temporarily unavailable.

To handle delayed delivery, mail systems use a technique known as *spooling*. When the user sends a mail message, the system places a copy in its private storage (spool†) area along with identification of the sender, recipient, destination machine, and time of deposit. The system then initiates the transfer to the remote machine as a background activity, allowing the sender to proceed with other computational activities. Figure 25.1 illustrates the idea.

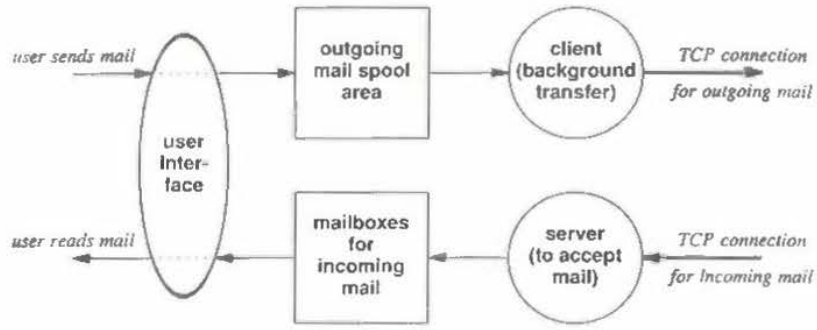

Figure 25.1 Conceptual components of an electronic mail system. The user invokes a user interface to deposit or retrieve mail; all transfers occur in the background.

The background mail transfer process becomes a client. The process first uses the domain name system to map the destination machine name to an IP address, and then attempts to form a TCP connection to the mail server on the destination machine. If it succeeds, the transfer process passes a copy of the message to the remote server, which stores the copy in the remote system's spool area. Once the client and server agree that the copy has been accepted and stored, the client removes the local copy. If it cannot form a TCP connection or if the connection fails, the transfer process records the time delivery was attempted and terminates. The background transfer process sweeps through the spool area periodically, typically once every 30 minutes, checking for undelivered mail. Whenever it finds a message or whenever a user deposits new outgoing mail, the background process attempts delivery again. If it finds that a mail message cannot be delivered after an extended time (e.g., 3 days), the mail software returns the message to the sender.

†Mail spool areas are sometimes called *mail queue* areas even though the term is technically inaccurate.

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