1. We assume that XYZ Corporation has three business offices and we want to design a data networks. These offices are in the cities of Atlanta, Boston, and Chicago. We assume that there are 24 employees in Atlanta, 32 employees in Boston, and 18 employees in Chicago. The traffic between the sites is generated by 3 principal applications. They are e-mail, external Web access, and distributed database. We summarize all the traffic involved in the table below. We assume that 20% of the internal e-mail, World Wide Web, and database traffic occurs in the busy hour, while we assume that the external e-mail arrives evenly throughout the day. On average each employee sends and receives 10 pieces of internal e-mail. Internal e-mail is used to circulate presentations, spreadsheets, and memoranda. While the base files are modest, the attachments are large and each piece of mail averages 50,000 bytes. In addition, there are 3000 pieces of e-mail received a day from the outside world (12000 bytes). Each of these necessitates a response. We assume that the external e-mail is evenly distributed among the users and does not have peaks and valleys like the internal traffic. Further, the company uses the WWW to conduct business. Each employee generates an average of 40 external Uniform Resource Locator (URL) requests/day. Each URL request generates an average of 12 small (128-byte) datagrams to set up the transfer, 6 in each direction, and an inbound transfer of a single large (2000-byte) datagram. Finally, the data to run the XYZ Corporation is distributed across 3 servers, 1 at each office. During the day each employee makes an average of 50 queries and 5 updates. The query flows to the first server and then, if the data needed is not local, the query flows to a remote server. The query packets average 600 bytes and the response packets average 3000 bytes. The probability of the data being on any server is 1/3. Unlike the internal e-mail traffic, it is spread evenly among the 3 sites. The updates involve an initial packet averaging 5000 bytes and a response of 500 bytes.

    a. Show the initial unoptimized solution and cost
    b. Show the traffic in the busy hour
    c. Show the internal e-mail volumes by a matrix
    d. Show the traffic tables for internal mail, external e-mail, WWW, and the distributed database
    e. Show overall traffic table during the busy hour

The data traffic between the sites

Traffic	Volume
Internal e-mail	10 pieces sent and received per employee/day
External e-mail	3000 pieces/day arriving at a steady rate
WWW	40 fetches/day/user
Database	50 queries + 5 updates per employee/day

The cost of data communications services and components

Item	Cost
Terminal Router	$2000 purchase price
Transit router	$3700 purchase price
WAN adapter	$500 purchase price
64000 bps interode link	$700/month
256000 bps internode link	$1400/month
2048000 bps internode link	$3800/month
64000 bps internet link	$1400/month
256000 bps internet link	2800/month
2048000 bps internet link	$7600/month