The Journey Inside℠: The Internet
Student Handout: Put It in Your Packet

Put It in Your Packet

When people are creating email messages, they tend to write in short bursts with a delay between the bursts. Sometimes messages are short. Sometimes messages are long. Imagine if each email message was sent on the Internet in one complete block and the Internet would stop all traffic until the complete message was done. If this method was used, once one user started sending a message, no one else could use the network until the entire message had been sent.

To avoid this problem, networks use some form of packet switching—organization of the data into small pieces—to transmit information. Every network does this according to a set of protocols or rules.

Each message is split into small pieces called packets. Each packet has a header containing the complete destination address. Each packet has a sequence ID that indicates where in the overall message the packet belongs. Each packet has a data block, which is a particular sized portion of the message. Each packet has an end-of-message identifier.

On the Internet, as soon as a message is ready to go, it's broken into packets. The packets don't wait for an opening big enough for all of them to fit in, but instead jump in individually or in groups whenever there's an opportunity. Waiting is avoided at all costs so the Internet is kept working at top speed.

If you could look at packets traveling one behind the other on the Internet, you would find that they are not necessarily from the same message. What's more, packets from a single message might travel completely different pathways. The receiving computer waits until all the packets making up the message arrive and then reassembles it. The message is then held until the receiver accesses the message from his email account.

Vinton Cerf and Robert Kahn developed the packet-switching approach to signal transmission. Their many contributions to networking were honored with a 1997 National Medal of Technology award.

Activities

1. You are going to send a message from your group to your "partner group." The sending group will stay in the classroom and the receiving group will be in the hallway.

   Each group is to compose a short message, such as, "It is time to go home. Put your books away and put on your coats."

   Write each word of the message on a separate card. On each card also put the destination address (the name of the group that will receive the message), the sender's address (the name of your own group), and a number that tells the order each word occurs in the message.

   Place the cards your group has made into a pile and mix them up.

2. Once both groups have their stack of cards prepared, decide which group will send the first message. Put the receiving group into position in the hallway.

   Assign one person the task of timing how long it takes the sending group to deliver the cards and the receiving group to reassemble the message. This person will provide the signal to begin sending cards.

   To send the message, each person in the sending group takes one of the cards. One at a time, students exit the room with a card and deliver it to the waiting group. The order in which group members exit is unimportant. However, each person can carry only one card at a time. It may be necessary for people to make more than one trip before all the cards are delivered.

   To receive the message, the receiving group merely accepts cards until all of the cards from the sending group arrive. Once they have all the cards, they must work to reassemble and read the message.

3. The two groups now exchange jobs and repeat the exercise. When you are finished, make sure each group has all the cards from its first message.

   Make sure the time taken to complete the task is recorded. Is there any difference in the time taken to complete the task? What might explain this time difference?

4. Create a new message. As before, each group will prepare a set of cards, mixed into a pile and ready for transmission.

   Before proceeding, see how many of the group can exit through the doorway of your classroom at the same time, shoulder to shoulder. This represents the bandwidth of the doorway to your classroom.

   Once you are ready to begin, have the timer give the signal to start. You are going to transmit the message to the group in the hallway again, but this time, have as many students as the door will allow to exit at the same time. If the door has a bandwidth of five, then five students will exit at the same time. Again, be sure each card has a destination address, the sender's address, and a sequence number.

   Have the group receiving the message accept the cards. Once all the cards are received, the message is to be reassembled.

   Calculate the time needed to deliver the cards and reassemble the message. Compare this to the first time. How much faster can you get the job done with greater bandwidth?

5. You might repeat this exercise if you can find a room that provides a doorway of a different size. Perhaps you can use the doorway to the cafeteria or the gymnasium. How does the bandwidth of these doorways compare to the classroom door? How wide is a doorway providing a 10-person bandwidth?

6. For this activity, you will need to have four groups working together. Your network is going to transmit two messages at the same time.

Two groups will transmit messages at the same time. Use the cards from the second message created by both groups. Each message is to be directed to one of the two receiving groups. Place all the cards into one pile and mix them up. Decide on what bandwidth your network will use for the activity.

Your network will need to have a router at the receiving end. Do you remember what the router will do?

Time how long it takes to have both messages sent, sorted, reassembled, and read by the receiving groups.

7. Have the sending and receiving groups change places. Use a different bandwidth figure and time the result.