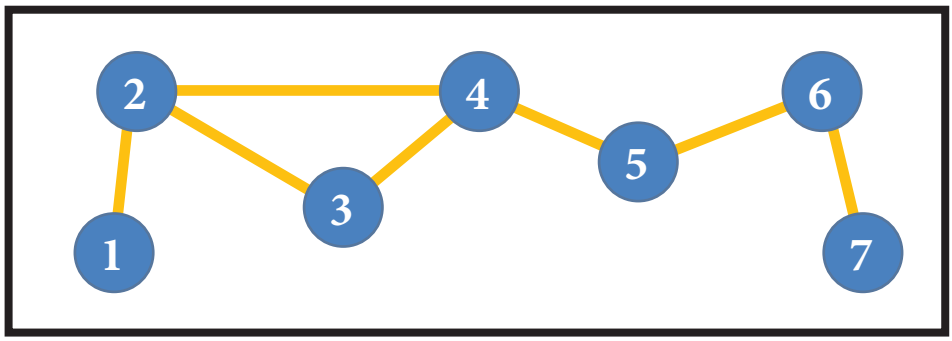
NETWORKING ACTIVITY

You will need the following items for this activity:

- 8 envelopes
- 8 index cards
- 8 large binder clips
- 1 marker
- Rope, cut into several 5-10 foot lengths

Rope activity

As a class exercise you can create a simple student network to pass a message. To create this network each student will be a node and we can use ropes as our links. Have the class stand up and you can randomly select a few to be our routers. Pass out ropes to the "routers"; they will hold one end of the ropes and hand the other end to some classmate (these could and should also be other "routers"). This will create our "network".



In the diagram, Nodes 2, 3, 4 and 5 are *routers* because they have a choice to make: *Which path is least congested?* Nodes 1, 6, and 7 have no such decision; they can only send data along one path. The internet is structured much this same way. Your home internet only connects through one carrier, your Internet Service Provider (ISP). Your ISP however may connect to multiple networks. Data will take the path that yields the fastest connection to your intended destination be it Google, Facebook, or Netflix.

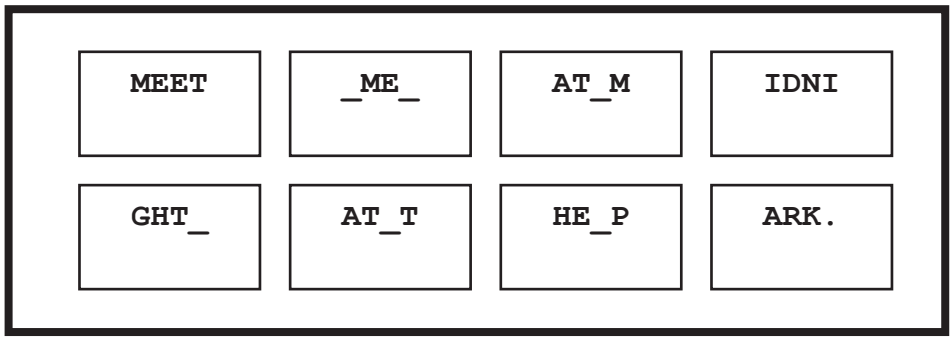
Number the index cards 1-8 on the back of each card to maintain order. These will be our packets. Actual packets contain numbers also so they can be reassembled in the proper order at their destination.

Develop a message and write it 4 characters at a time across multiple index cards. When writing a space, use an underscore character to show each packet contains 4 characters.

You may also use the following prepared example messages:

"MEET_ME_AT_MIDNIGHT_AT_THE_PARK."
"SEND_FIVE_DOLLARS_BEFORE_FRIDAY."
"WEATHER_WILL_BE_COLD_FOR_ESCAPE."
"THE_PACKAGE_WAS_PUT_INTO_BOX_26."

A message will be divided up across index cards like so:



Place each index card into its own envelope. Clip a binder clip on each envelope.

Select a source node and destination node. Have the source send the packet to a destination by threading the rope through the ring of a binder clip so the packet can slide along the rope to the next node.

At the next node, the packet will be taken off one rope segment and threaded onto the next rope segment. In networking, this is referred to as a "*hop*" – when a packet switches from one link to the next. Each hop increases the delay in the recipient receiving the message, this is referred to as *latency* or *lag*. Each router will make a decision as to which rope to select to continue sending the packet along. If each choice can get the message to the destination, the router should send the packet via the path with less congestion or backed-up packets. (Make sure that the packets go through multiple routers to get to the destination.) The individual packets can also take different paths to the destination – real internet traffic can take many, many different paths to reach a single, common destination.

Once all the packets have arrived at the destination, the receiver can reorder them (thanks to the numbering of index cards) and make sense of the message. Real packets are received as they come in, but reordered and reassembled once all packets have been received.

Modifications

Denial of Service

You can also approach one of the routers and "barrage" them with questions from the accompanying packet to recreate a *Denial of Service*, or DoS, attack.

Man in the Middle

Have the students send another message as before. This time as the packets are traversing the ropes reach in and intercept a packet and replace it with something else. This would be something called a *man-in-the-middle* attack.

To prepare for this, substitute the text on one packet. The message will still go through but the contents and meaning of the message will be fundamentally different. Consider the following changes:

"MEET_ME_AT_MIDNIGHT_AT_THE_P**IER**." ... This changes location!

"SEND_**NIN**E_DOLLARS_BEFORE_**MON**DAY." ... changes amount of money requested or date!

"WEATHER_WILL_BE_**WARM**_FOR_ESCAPE." ...escapees may not plan properly for escape!

"THE_PACKAGE_WAS_PUT_INTO_BOX_**62**." ...a simple transposition of numbers changes everything!

Packet Sniffing

Simply looking at the contents of each packet as they go should send up a red flag for anyone watching. Why do they care what's in the envelopes? What are they looking for?! What if a 16 digit long string of numbers was discovered? Someone that is packet sniffing could be looking for credit card numbers! If someone looks for a pattern like a string containing an @ followed by something then a .com, .org or .edu; they may be sniffing for email addresses. Spammer alert! Worse still, if that pattern alerts the sniffer to copy the next string of text that comes through, they could be stealing an email account's password! The common network protocols used for email POP3 and IMAP actually send username and passwords in plain text. So without any additional security measures, email is quite vulnerable to attack. (Rest assured most email services employ encryption methods to overcome this known insecurity.)

Secure Communication

Encryption

With some packet sniffing and man in the middle attacks, it is easy to disrupt communication on our simple rope network. How can we secure better? Encryption is one solution. By creating a simple form of encryption like a shift cipher or substitution cipher, we can harden our message from any would-be attackers. If they do not know our original message, they cannot be sure which part of the message to attack to substitute letters or numbers.

Checksum

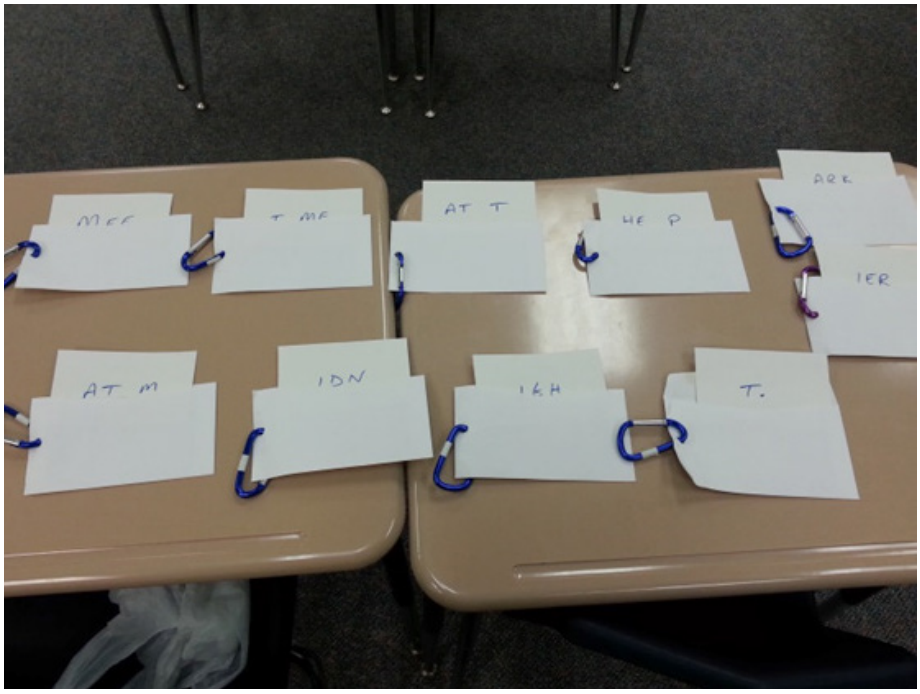
Another way we can ensure our message is not tampered with is the use of checksums. In the next lesson we'll explore uses of checksums but it goes like this:

Convert each letter to a number value (i.e. A=1, B=2, … Z=26). Add up all the numbers from a message. Transmit this sum separate from the message itself. If any letters are changed, this sum will change. The recipient will receive the message, add up the number values of all letters in the message and compare against the transmitted checksum. If the two sums are equal, we can be relatively sure the message was not altered during transmission.

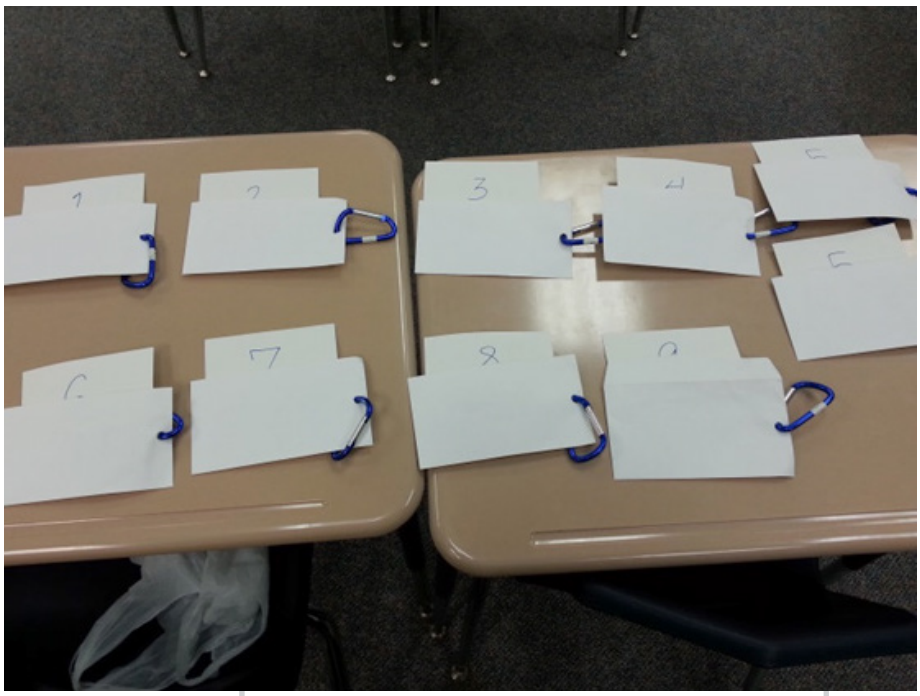
Pictures

Visuals from a previous installation of this activity follow:

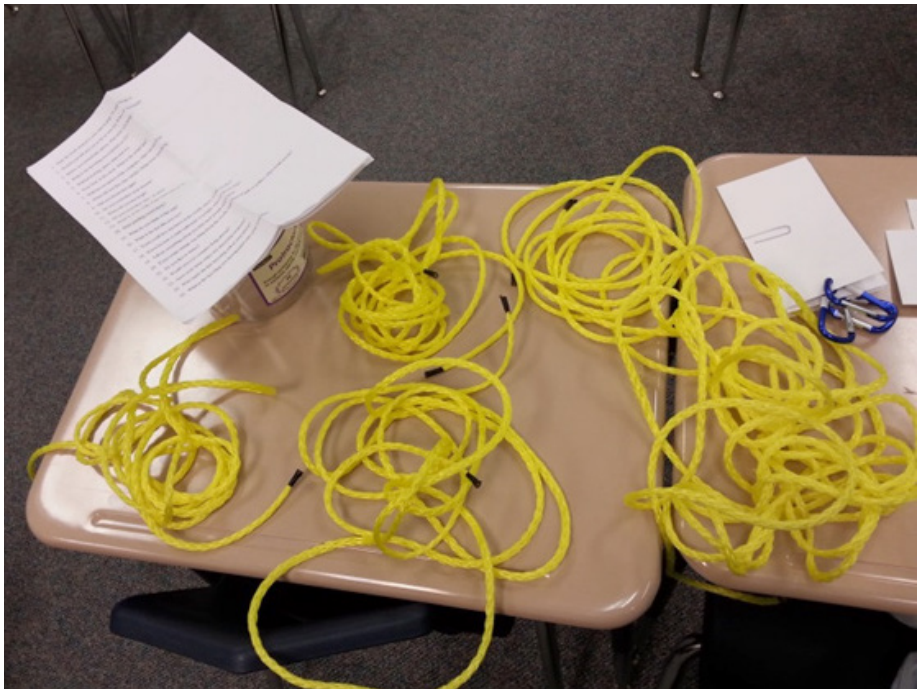
- Picture detailing the message broken into packets with the extra packet changing "park" to "pier" to be used to demonstrate the "Man in the Middle" form of malware. Note the purple carabineer to identify the altered packet.



- Picture detailing the packets turned over to show Sequence Numbers so students can reassemble the message in the correct order.



- Picture detailing the rope used to form the "human network" as well as the questions used to demonstrate the "Denial of Service" form of malware.



- These pictures show how the activity was done with carabineers. Note that the materials list includes binder clips with no need for hole punches. This ensures that the envelopes can be used over and over with no chance of tearing off of a carabineer.

1. Grab the book nearest to you, turn to page 18, and find line 4.
2. Stretch your left arm out as far as you can, what can you touch?
3. Before you started this survey, what were you doing?
4. What is the last thing you watched on TV?
5. Without looking, guess what time it is
6. Now look at the clock. What is the actual time?
7. With the exception of the computer, what can you hear?
8. When did you last step outside? What were you doing?
9. Did you dream last night?
10. Do you remember your dreams?
11. When did you last laugh?
12. Do you remember why / at what?
13. What is on the walls of the room you are in?
14. Seen anything weird lately?
15. What do you think of this quiz?
16. What is the last film you saw?
17. If you could live anywhere in the world, where would you live?
18. If you became a multi-millionaire overnight, what would you buy?
19. Tell me something about you that most people don't know.
20. If you could change one thing about the world, regardless of guilt or politics, what would you do?
21. Do you like to dance?
22. Would you ever consider living abroad?
23. Does your name make any interesting anagrams?
24. Who made the last incoming call on your phone?
25. What is the last thing you downloaded onto your computer?
26. Last time you swam in a pool?
27. Type of music you like most?
28. Type of music you dislike most?
29. Are you listening to music right now?
30. What color is your bedroom carpet?
31. If you could change something about your home, without worry about expense or mess, what would you do?
32. What was the last thing you bought?
33. Have you ever ridden on a motorbike?
34. Would you go bungee jumping or sky diving?
35. Do you have a garden?
36. Do you really know all the words to your national anthem?
37. What is the first thing you think of when you wake up in the morning?
38. If you could eat lunch with one famous person, who would it be?
39. Who sent the last text message you received?
40. Which store would you choose to max out your credit card?
41. What time is bed time?
42. Have you ever been in a beauty pageant?
43. How many tattoos do you have?
44. If you don't have any, have you ever thought of getting one?
45. What did you do for your last birthday?
46. Do you carry a donor card?
47. Who was the last person you ate dinner with?
48. Is the glass half empty or half full?
49. What's the farthest-away place you've been?
50. When's the last time you ate a homegrown tomato?
51. Have you ever won a trophy?

1. Are you a good cook?
2. Do you know how to pump your own gas?
3. If you could meet any one person (from history or currently alive), who would it be?
4. Have you ever had to wear a uniform to school?
5. Do you touch-type?
6. What's under your bed?
7. Do you believe in love at first sight?
8. Think fast, what do you like right now?
9. Where were you on Valentine's day?
10. What time do you get up?
11. What was the name of your first pet?
12. Who is the second to last person to call you?
13. Is there anything going on this weekend?
14. How are you feeling right now?
15. What do you think about the most?
16. What time do you get up in the morning?
17. If you had A Big Win in the Lottery, how long would you wait to tell people?
18. Who would you tell first?
19. What is the last movie that you saw at the cinema?
20. Do you sing in the shower?
21. Which store would you choose to max out your credit card?
22. What do you do most when you are bored?
23. What do you do for a living?
24. Do you love your job?
25. What did you want to be when you grew up?
26. If you could have any job, what would you want to do/be?
27. Which came first the chicken or the egg?
28. How many keys on your key ring?
29. Where would you retire to?
30. What kind of car do you drive?
31. What are your best physical features?
32. What are your best characteristics?
33. If you could go anywhere in the world on vacation where would you go?
34. What kind of books do you like to read?
35. Where would you want to retire to?
36. What is your favorite time of the day?
37. Where did you grow up?
38. How far away from your birthplace do you live now?
39. What are you reading now?
40. Are you a morning person or a night owl?
41. Can you touch your nose with your tongue?
42. Can you close your eyes and raise your eyebrows?
43. Do you have pets?
44. How many rings before you answer the phone?
45. What is your best childhood memory?
46. What are some of the different jobs that you have had in your life?
47. Any new and exciting things that you would like to share?
48. What is most important in life?
49. What Inspires You?

(Vicki Brown, 2004, http://www.cfcl.com/vlb/Memes/Questionaires/random_1.html)