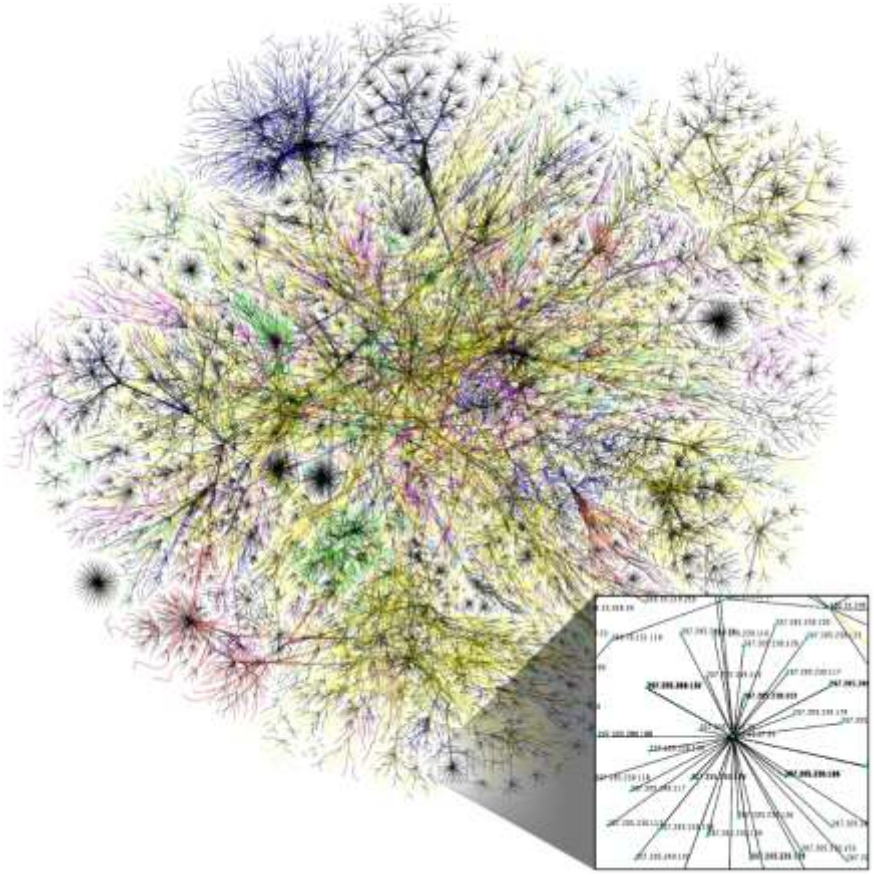
That's How I Get A Text!



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Caption: A computer generated diagram of the internet.

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RET Site: Cyber Security Initiative for Nevada Teachers (CSINT)

Grade Level 5 (4-6)

Time Required 50 minutes

Summary
Students increase their understanding of the architecture of the internet by engaging in a physical simulation. Students problem solve, resolve issues, and test solutions to uncover the identification information needed for data to transmit across the internet in a network.

Engineering Connection

Engineers develop simple physical models to understand how related components within complex systems function and react under specific conditions. The simple physical models help engineers diagnose problems and failure points to make

improvements or design new components for the system. Engineers also use models to increase communication and understanding of their ideas with other professional outside the field of engineering.

Educational Standards

State STEM Standards

Nevada,2018, K-12 Computer Science Standards,5.NI.NCO.1 (Grade 5):Explain the concept of network protocols.

Nevada,2018, K-12 Computer Science Standards,4.NI.NCO.1 (Grade 4):Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the internet, and reassembled at the destination.

ITEEA Standards

ITEEA, 2000, Standard 1: The Nature of Technology, C (grades 3-5): Students will develop an understanding of the characteristics and scope of technology.

NGSS Standards

NGSS, 2012, Engineering Design ETS1-2 (grades 3-5):Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

CCSS Standards

CCSS,2010,Math, Practice MP2 Reason abstractly and quantitatively.(Grades K – 12)

CCSS, 2010, Math, Measurement and Data 5.MD.1(grade 5):Convert like measurement units within a given measurement system.

Pre-Requisite Knowledge

The ability to make reasonable estimates, understanding of division, and multiplication.

Learning Objectives

After this lesson, students should be able to:

- Model the flow of data through a network.
- Explain how internet protocols and routers ensure data is sent, received, and reassembled.
- Explain the identification information contained in data.

Material List

- pack of index cards (100)
- pack of sticky colored dots (5 colors: color 1 sender, color 2 receiver, color 3 total number of packets, and color 4 the sequence of the packets.)
- timer (seconds)
- class set of calculators
- large tip black marker

Lesson preparation

- prepared messages on index cards

  message 1: card 1: All, card 2: you card 3: nee, card 4:d is, card 5: lov, card 6:e ma, card 7:th a, card 8: nd e, card 9: ngi, card 10:nee, card 11 rin, card 12 g.

- message 2 : card 1: Ido, card 2: n't k card 3: now, card 4:if I, card 5: can, card 6: go o, card 7:n fri, card 8: day, card 9: bec, card 10:aus, card 11: e I h, card 12: ave, card 13: soc, card 14:cer, card 15:pra, card 15:cti, card 16:ce.

  *prepare this message with your designated colored dot theme (should match message 1)

- prepared time conversion chart on chart paper

  60 seconds= 1 minute

  60 seconds = 60,000 milliseconds

- prepared direction chart on chart paper
  1. Each router (one student) can hold only one packet (index card) at a time.
  2. Packet (index card) should be sent in the general direction of the receiver.
  3. No one can move from their spot other than to pass packets (index cards).

Introduction / Motivation

How many of you have a cell phone? (Wait for the students to respond.) When you send a text, have you ever wonder why you see the message, please resend your message. Any ideas? (Listen to student ideas.) Your challenge is figure out the identification data needed within a message. Also to determine when you would receive the message, please resend your message.

Procedure

with students

1. Designate a sender, a receiver, two protocols, and the rest of the students will be routers.
2. The sender and receiver should be at opposite ends of the classroom.
3. One protocol should stand an arm's length away, but directly in front of the sender. The other protocol will be in the same position in front of the receiver.
4. The rest of the students (routers) should place themselves in between the sender and receiver. The routers should be somewhat evenly spread out, an arm's distance away from each other, and their arrangement should not create an obvious direct path to the receiver.
5. Now our class created network will transmit the sender's text message to the receiver. Shuffle the prepared packets. (The colored dots and the Internet Network Class System Teacher Master should be accessible.)
6. Read aloud the direction chart to the students.
7. Hand all the packets to the sender.

8. Use the Network Class System Teacher Master document to pause the physical simulation during the five runs to ask the questions.

   After run 1: What does a packet need to continue?

   - Students should say, sender, receiver, or both. (Place the corresponding colored dot on each packet. Depending on their reply continue to run 2 or go directly to run 3.)
   - Restart the simulation.

   After run 2: What does a message need to continue?

   - Students should say, sender. (Place the corresponding colored dot on each packet.)
   - Restart the simulation from the beginning.

   After run 3: What does a message need to be in the correct order?

   - Students should say, the total number of the cards. (Place the corresponding colored dot on each packet and write the number 12.)
   - Restart the simulation from the beginning.

   After run 4: What does a message need to be in the correct order?

   - Students should say, the number of the card and where the card is in the message. (Place the corresponding colored dot on each packet and their sequence number.)
   - Restart simulation from the beginning

9. After run 5: Time the rerunning of the simulation without pausing. (Present the time in seconds to the students.)
10. What difficulties or problems did you discover while running the simulation without pausing? How might we fix these problems? Would these fixes work with more than one message in the network?
11. The students break into small groups of 3-4 students to discuss the questions for about 5-6 minutes. After the time is up lead a class discussion to narrow down 2-3 fixes for the simulation. (Possible answer: Sets of packets need to find the quickest way to the sender.)
12. In what unit of time does a message take place in? What was your groups' evidence to support your unit of time measurement? Why is the unit of time important in a network? (You will need to help students realize the answer is milliseconds due to efficiency and the needs of society.)
13. Based on the fixes run the simulation with the students again while timing. (You will need to introduce the second message into the network at this time. The students will need a total of 5 sets of timing in seconds.)
14. Have the students work in groups to convert the seconds into milliseconds and analyze the data along with the data of the packets through the network. (For students who are struggling with using the conversion chart have them figure out

60 x__= 60,000.)

15. When during the simulation would the sender receive the message, “please resend your message?” (The students should realize this would happen when a packet can’t reach the reassemble point.)

Lesson Background & Concepts for Teachers

The TCP/IP is an internet protocols suite. The TCP/IP uses information in the header of the data to find a route from the sender to the receiver. Data transmitted through the internet is split into packets, and each packet contains the header information. The header includes the sender, the receiver, and the instructions of how the packets are reassembled at the final destination. The routers serve as connection spots along the route for the packets.

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Caption: Humans play a vital part in making the internet network function efficiently.

Vocabulary / Definitions

Word	Definition
Protocols	A set of rules that determine how data travels electronically.
Packet	A piece of data (image, text, video, etc.) that is sent over the internet.
Routers	Connection points along the route that packets travel through.

Assessment

Post-Introduction Assessment

Understanding Check: Have the students respond to the questions in the procedure section (step 10) to check their understanding.

Lesson Summary Assessment

Post-Quiz: At the conclusion of the lesson, give the Picture Post-Quiz by handing out

copies to students.

References

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SAE International. (2018). Cybersecurity: Keeping Our Networks Secure. Retrieved August 3, 2018, from https://www.sae.org/learn/education/curriculum/keeping-our-networks-secure

Attachments

Network Class System List Teacher Master
Picture Post-Quiz

Contributors

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Attachments

Picture Post-Quiz
Directions: Draw or glue a picture in the box. Use words and sketches to explain the process of how your friend would get your picture through the internet.
Picture
Explanation

Network Class System Teacher Master				
1 Message SD to RR	1 Message SD to RR	1 Message SD to RR	1 Message SD to RR	1 Message SD to RR
Run 1	Run 2	Run 3	Run 4	Run 5
SD	SD	SD	SD	SD
Protocol	Protocol (RR)	Protocol (RR, SD)	Protocol (RR, SD, number of packets)	Protocol (RR, SD, number of packets, order of packets)
packet can not continue	packet can not continue	RTs	RTs	RTs
		Protocol	Protocol	Protocol
		RR	RR	RR
		OUT OF ORDER (packets)	OUT OF ORDER (packets)	ORDERED (packets)
Sender(SD)				
Receiver (RR)				
Router (RT)				
Protocol ( ) identification information - colored dot				