DR. MARIAN CROAK

TRADING CARD LESSON

SUMMARY

Dr. Marian Croak is a pioneering technology leader known for her groundbreaking work in Voice over Internet Protocol (VoIP) and for inventing a text-to-donate application during the aftermath of Hurricane Katrina. These lessons are intended for grades 6-12. The activities focus on computer science, literacy, energy transformation, and community emergency management.

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Marian Croak

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Background

Dr. Marian Croak is a technology industry leader, mentor, and mother of three with more than 200 patents. A pioneer in telecommunications technology, Dr. Croak's work advanced Voice over Internet Protocol (VoIP), a form of communication technology that allows people to make secure phone calls using the internet instead of a typical landline or analog connection. In the aftermath of Hurricane Katrina, Dr. Croak invented a text-to-donate application, which revolutionized how people could give money to charitable causes.

Marian Croak grew up in New York City with her parents and sister. She greatly admired her father, who did not have a formal education but was brilliant and creative, and inspired a young Marian to work hard. She always knew her father was immensely proud of her, which kept her going through difficult times. Many of Dr. Croak's childhood memories are of learning how to fix problems that came up around the house. She became interested in how things worked, and often figured out how to fix broken household appliances. Dr. Croak said her upbringing prepared her for her future: "My whole profession has been looking at something that needs to be changed or fixed."

Dr. Marian Croak's contributions to communications technology have made a lasting impact. Her inventions enable much of the technology our society relies on to communicate, especially through the internet.

Student activities

- A USPTO inventor trading card activity challenge: Communicate like a VoIP
- The binary broadcast
- How do computers work? How does the internet work?
- How does voice-over-internet protocol (VoIP) work?
- Using technology to help others

Grades 6-12 content and topics

Engineering, Science, Math, ELA, and Computer Science

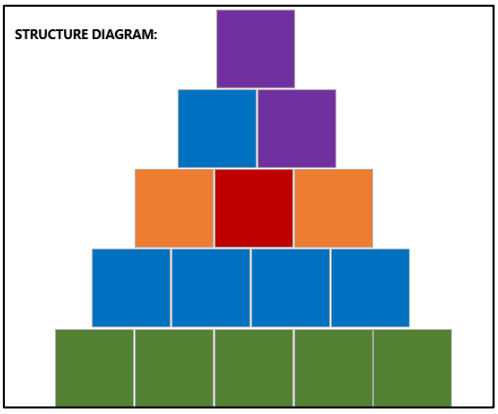
Computational thinking, energy transformation, analog and digital transmission, binary code, wave frequency, logic

Engage: A USPTO inventor trading card activity challenge: Communicate like a VoIP

Time: 40 minutes

Background

The engage section of this lesson plan will introduce students to the work of Dr. Marian Croak and her Voice over Internet Protocol (VoIP) invention. Students will an activity that demonstrates the differences between direct computer-coded directions and verbal directions by building a structure using each form of communication.



Materials

- Structure diagrams 1 and 2 printed in color
- Wooden or colored blocks printed and cut out
- Direction or coding cards cut out

Instructions

1. Choose to use wooden blocks or colored block cutouts. Prepare the computer coding card cutouts so students can use both methods with a partner.
2. Students work in pairs. One partner manipulates the blocks while the other gives directions using two structure diagrams and computer coding instructions.
3. During the first trial, the partner with instructions will select one of the cards and give instructions to the partner who is building using the computer coding cards.

4. During the second trial, the partner with instructions will select the other card and give verbal instructions to the partner who is building the structure.

Student activity handout

- USPTO inventor trading card activity challenge: Communicate like a VoIP

Explore: The binary broadcast

Time: 40 minutes

Background

The explore section of this lesson plan will introduce students to how the binary system transfers information through the internet. Students will learn about the basics of the binary system, based on a code using 1s and 0s, used to send and receive information between computers. Students will then make connections between the binary system and Dr. Marian Croak's visionary approach to transmitting voice calls and messages over the internet rather than by wired technology like telephone landlines.

Materials

- "The binary broadcast" activity handout; includes:
    - ASCII Binary Character Table
    - "Convert your name to ASCII then to binary code" activity
- Decode the mystery message cards (Appendix I)
- Flashlight

Instructions

Watch the Code.org video titled "How Computers Work: Binary and Data." The video series "How Computers Work" may also be a helpful resource for your classroom.

1. Explain to students that binary code enables data transmission between computers and show them the ASCII Binary Character Table.
2. Demonstrate how letters and numbers can be converted from our alphabet system to binary code using the ASCII Code and the "Convert your name to ASCII then to binary code" activity sheet.
3. Give each team a flashlight. You may want to give students a tool for tapping, but this is optional. These will be used for the light and tap communication method.
4. Explain the light and tap communication method students will use to represent binary code to send messages to each other. One student will be the receiver, and one will be the sender. After each message is decoded, a different student will be the sender.

Student activity handout

- The binary broadcast

Explain: How do computers work? How does the internet work?

Time: 40 minutes

Background

The explain section of this lesson plan engages students in learning about how computers work and how the internet functions.

Materials

- Access to Code.org video library: https://code.org/educate/resources/videos
- Activity sheet for video review and discussion

Instructions

1. Students work their way through the videos indicated on the activity sheet; all videos are from the "How Computers Work" series and the "How the internet works" series.
2. Students then meet in groups to compare and add to the notes they took while watching each video.
3. Each group will select a video and share what they learned with the class.

Student activity handout

- How do computers work? How does the internet work?

Elaborate: How does Voice over Internet Protocol work?

Time: 40 minutes

Background

In the elaborate section of this lesson plan, students will learn about the technology that helped Dr. Marian Croak invent a process for sending audio messages over the internet: Voice over Internet Protocol (VoIP). Students will learn how packets of information are transmitted and received by computers. Transmission of data packets allows a great deal of information to be sent and received, while preventing computer interruptions or slow-downs. Students will play a game demonstrating how packets are transmitted across networks: Students will move puzzle pieces with a message across the game board every time they draw a pathway card; as the puzzle pieces arrive at the computer on the receiver end (the opposite side of the game board), students will put the pieces together, revealing the entire message.

Materials

- Game board, laminated (one per group)
- Puzzle pieces, cut out and laminated (one set per group)
- Packet pieces, cut out and laminated (one set per group)
- Print "Information Speedway" game activity sheet

Instructions

1. Students will play the "Information Speedway" game by moving puzzle pieces across a transmission field. The puzzle pieces represent packets of information that students put together on the other side of the game board.
2. Each group receives a game board, jigsaw puzzle pieces, and packet pieces.
3. Groups start timers when they are ready.
4. One group member is assigned to put the puzzle pieces together after they cross the transmission field (game board).
5. Other group members select a jigsaw puzzle piece and draw packet cards, moving their puzzle pieces across the transmission field.
6. They repeat the process with another jigsaw puzzle piece until all the pieces have moved across the transmission field.
7. Group members work together to complete the jigsaw puzzle and read the message. Once complete, they stop the timer and record their time on the activity sheet.

Student activity handout

- How does Voice over Internet Protocol work?

Evaluate: Using technology to help others

Time: 40 minutes

Background

In the evaluate section of this lesson plan, students will learn about the text-to-donate app that Dr. Marian Croak developed to enable contributions to Hurricane Katrina victims, and invent a helping technology of their own. Dr. Croak filed a patent for this app in 2005.

Materials

- Flip chart paper
- Markers

Instructions

1. Students follow the student activity sheet to invent technology that helps others.
2. Perform a prior art (patent) search to see if others have developed similar inventions.
3. Students create a brand for their invention.
4. Students pitch their ideas to an audience of stakeholders using poster paper or a class-sharing platform.

Student activity handout

- Using technology to help others

Vocabulary

Binary code
A code that uses two symbols to communicate information. Computer processing uses the two-symbol system to receive and send messages in 1s and 0s, which indicate on and off. The binary code assigns bits to each character.

Analog signal
A continuous wave with an upper and lower value that can send signals across wires or radio waves. The strength and frequency of the wave may vary. Sound is an example of an analog wave.

Digital signal
A binary signal that provides a constant signal that does not vary or have a range of strength or frequency.

Voice over Internet Protocol (VoIP)
Technology that allows people to make calls using an internet connection. Information is transmitted through packets sent over the internet and recombined at the receiver end.

Intellectual property (IP)
Creations of the mind that may include but are not limited to inventions, written, artistic, and design works. These may be protected by acquiring a patent, trademark, copyright, or trade secret.

Patent
An exclusive property right granted by the United States Patent and Trademark Office to inventors to make, use, or sell their inventions within the United States for a limited period.

Trademark
A word, name, symbol, or device that is used in trade with goods and services to indicate the source of the goods and services and to distinguish them from the goods and services of others.

Copyright
A form of protection provided to the authors of "original works of authorship," including literary, dramatic, musical, artistic, and certain other intellectual works, both published and unpublished.

Trade secret
Information that has either actual or potential independent economic value by not being generally known, has value to others who cannot legitimately obtain the information, and is subject to reasonable efforts to maintain its secrecy. For example, the formula for the beverage Coke®.

Standards alignment

Math, Grades 6-12

Mathematical Practices
Problem Solving and Reasoning

Next Generation Science Standards, Grades 6-12

Science and Engineering Practices
Constructing Explanations and Designing Solutions

Disciplinary Core Ideas
HS-PS4 Waves and their Applications in Technologies for Information Transfer
MS-PS4 Waves and their Applications in Technologies for Information Transfer

Crosscutting Concepts
Influence of Science, Engineering, and Technology on Society and the Natural World

English Language Arts Standards, Grades 6-12

Media Arts
WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-1)

Computer Science Standards

Interpersonal Communication
Impacts of Computing

Practices
Collaborating Around Computing

Computing Systems
2-CS-01 Recommend improvements to the design of computing devices based on an analysis of how users interact with the devices.

2-NI-04 Model the role of protocols in transmitting data across networks and the Internet.

Networks and the Internet
3A-CS-02 Compare levels of abstraction and interactions between application software, system software, and hardware layers.

A USPTO inventor trading card activity challenge: Communicate like a VoIP

Dr. Marian Croak

Inventor and Problem Solver

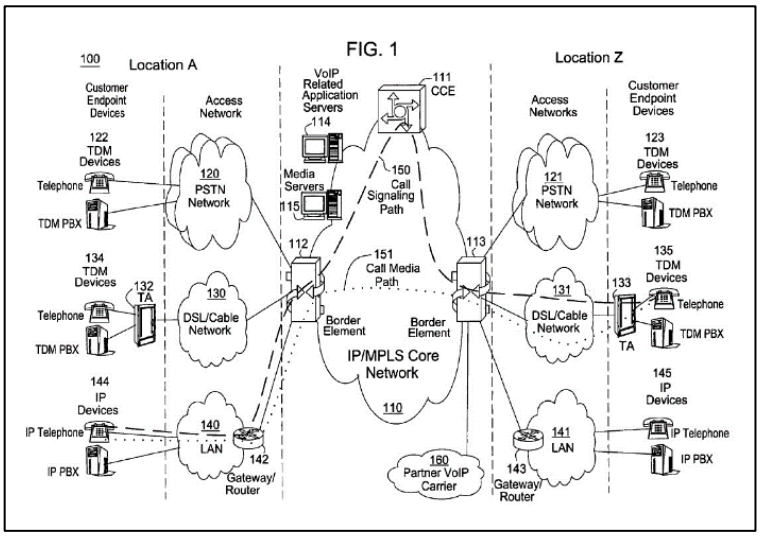
Dr. Marian Croak is a pioneer in telecommunications technology. Her inventions advanced Voice over Internet Protocol (VoIP), which allowed people to make secure, reliable phone calls over the internet instead of a typical landline or analog connection. Dr. Croak holds patents for more than 200 inventions, including the first text-to-donate application which she developed in the aftermath of Hurricane Katrina. She is a technology team leader, mentor, and mother of three who inspires others through her commitment to innovation, leadership, and service.

Activity

Demonstrate how computers were used to send messages *before* Dr. Marian Croak's inventions in VoIP communication. Demonstrate how communication using computers changed *after* Dr. Marian Croak's inventions.

Background

During the COVID-19 pandemic, we relied heavily on technology that enabled us to communicate over the internet. This technology has become a valuable tool for businesses, governments, researchers, and schools. Before Marian Croak invented VoIP, communication via the internet was typed and transmitted. Her patented technology revolutionized how people learn, work, and socialize. Many of the ways we use the internet today are entirely thanks to Dr. Croak's work.



Patent drawing from Marian Croak's "Method and apparatus for providing voice control for accessing teleconference services." U.S. Patent 9219820 B2

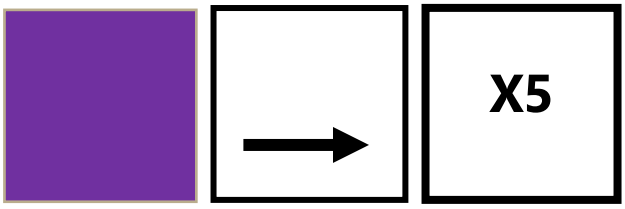
Materials

- Structure diagrams 1 and 2 printed in color
- Wooden blocks or colored blocks printed and cut out
- Direction or coding cards cut out

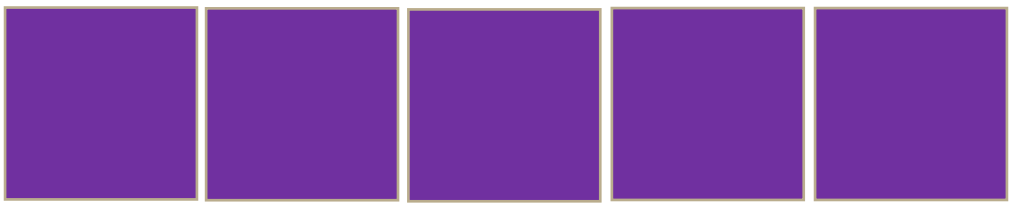
Directions

1. Select structure diagram 1; do not show it to your partner.
2. Use the coding instruction cards to communicate how to build the structure diagram 1.
3. Start at the bottom of the structure and select a coding card for a block with the same color as the blocks in the structure diagram.
4. Select an arrow to show your partner which direction to add more blocks. Select the color of the next block or a multiplication factor card to show that they need to add a specific number of the same block.
    a. For example:

Instruction cards:



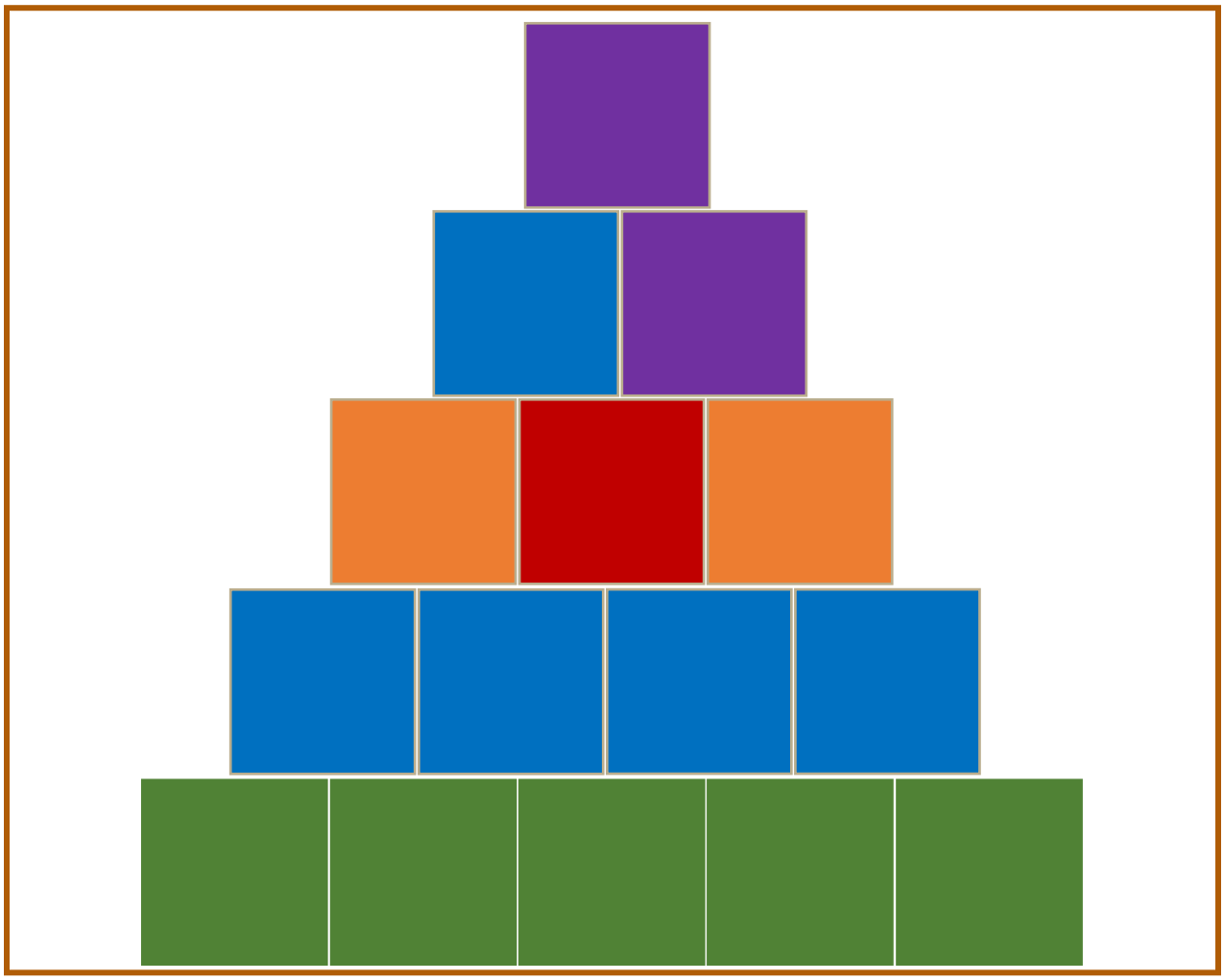
Result:



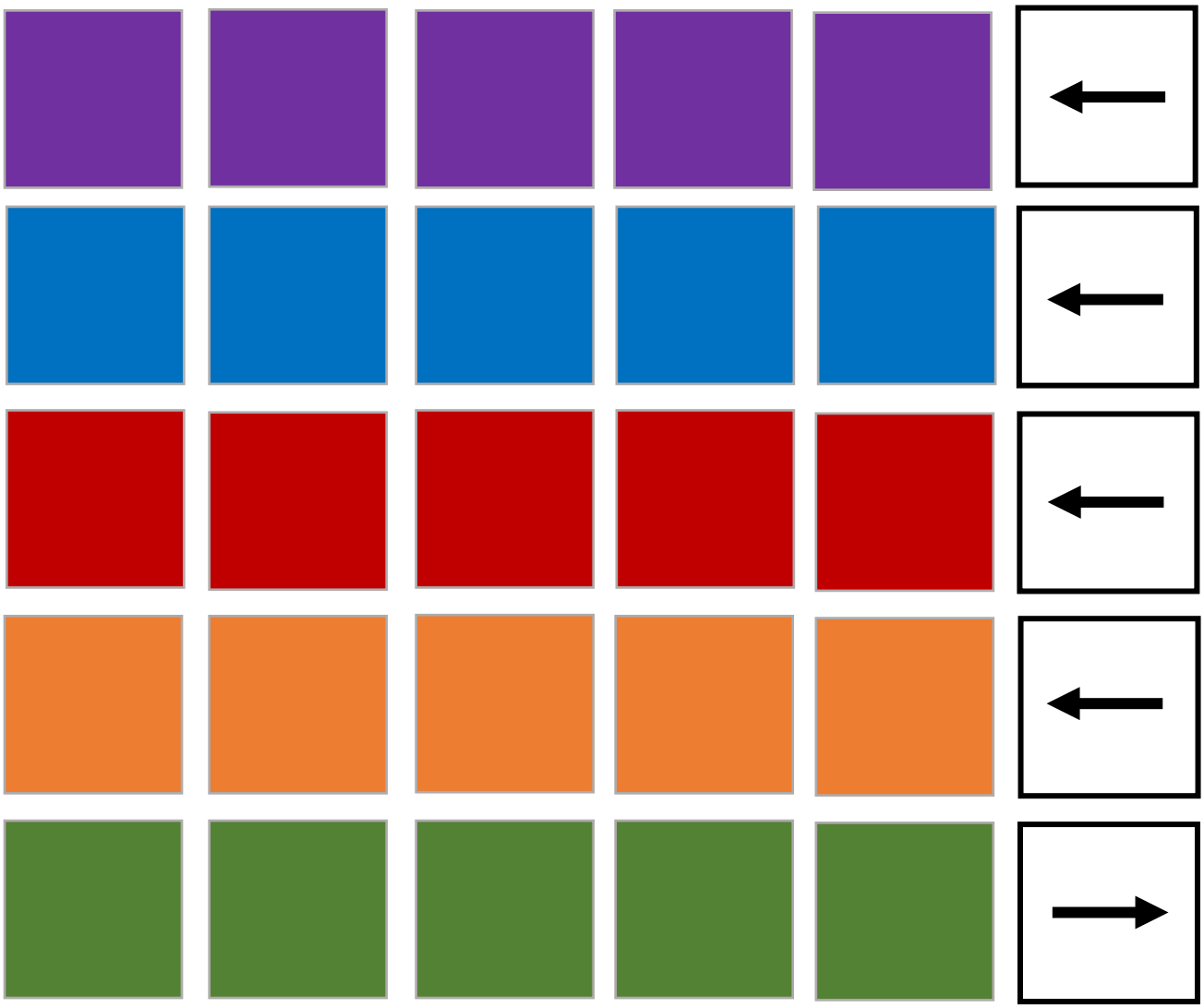
- This communication form simulates how internet communication worked *before* Dr. Marian Croak invented VoIP.

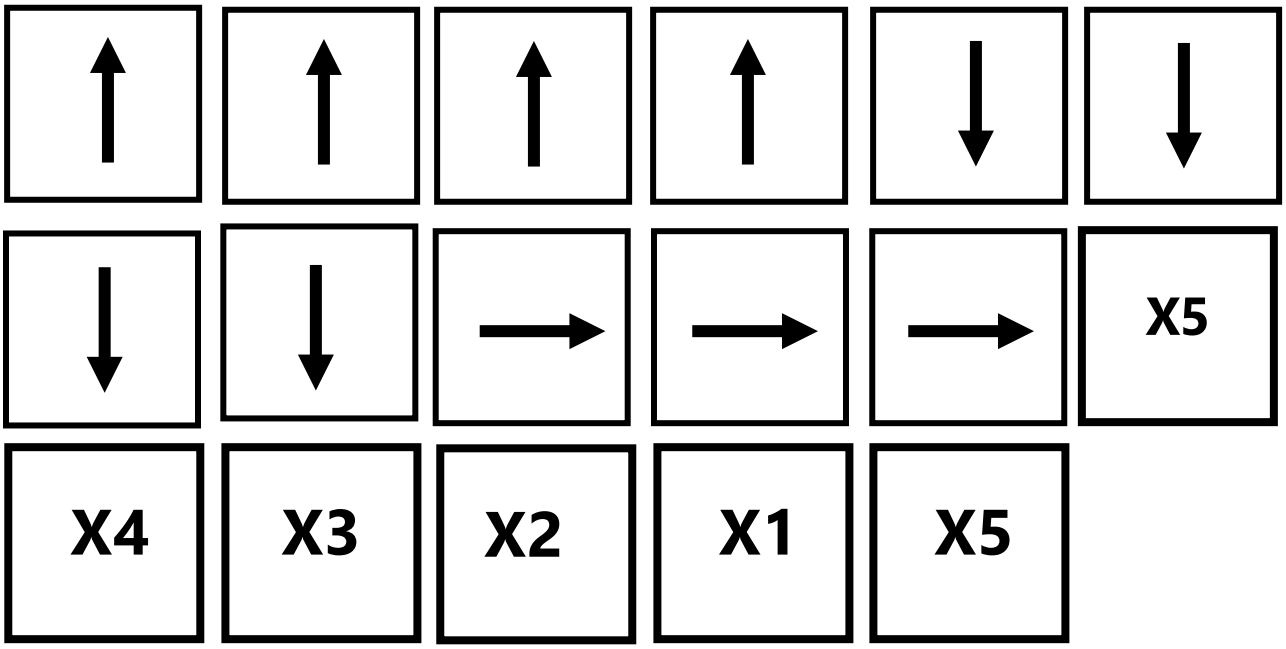
1. Select structure diagram 2; do not show it to your partner.
2. Use verbal communication to explain in words how to build the structure.
    - This form simulates how internet communication worked *after* Dr. Marian Croak's VoIP invention.

STRUCTURE DIAGRAM 1:

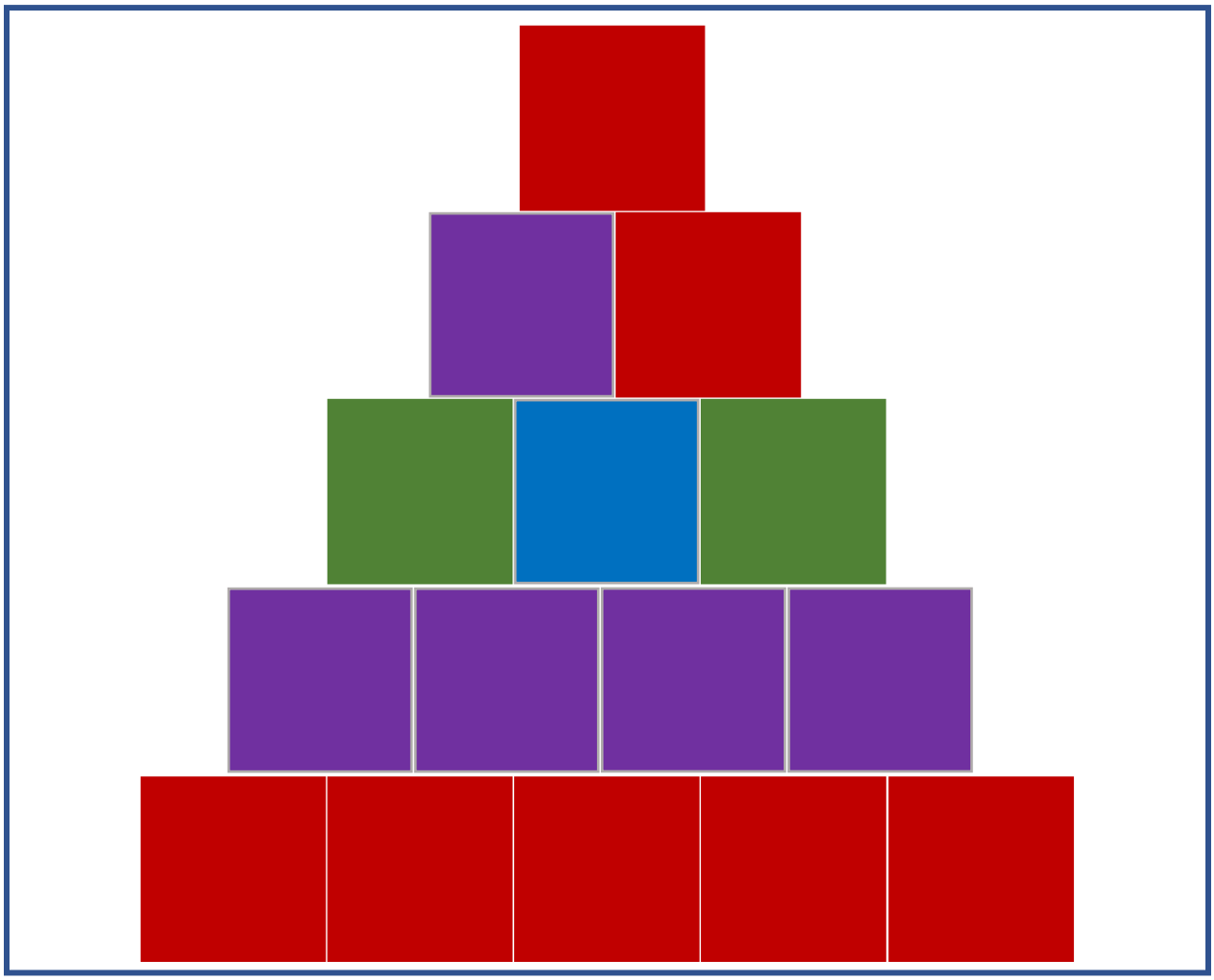


DIRECTION AND BLOCK CARDS:





STRUCTURE DIAGRAM 2:



What is intellectual property (IP)?

Intellectual property (IP) refers to creations of the mind, such as inventions, literary and artistic works, designs, symbols, names, and images used in commerce. There are four types of intellectual property protection: patents, trademarks, copyrights, and trade secrets.

What ideas for an invention, product, or service do you have?
How could you express your intellectual property so that it is protected?

Marian Croak is an inventor. You are, too!

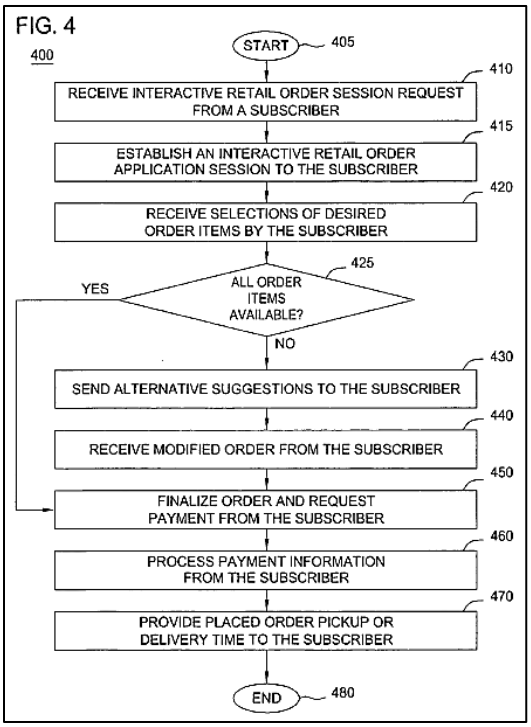
Inventors are problem solvers. If you have ever solved a problem or thought of a new way to accomplish a task, you were an inventor! One day, you could invent something that solves a problem and become the subject of one of our inventor trading cards.

What will you invent?

What is a patent?

A patent is an exclusive property right granted by the government that allows an inventor to stop others from making, using, or selling their invention for a certain amount of time without permission. This right gives the inventor a chance to develop their inventions further to benefit society. Patents also allow the public to learn how an invention works so that others can learn from it and develop ways to improve it.

Do you have an idea for an invention that you could patent?



Patent diagram from Marian Croak's "Method and Apparatus for Placing Interactive Retail Orders." U.S. Patent 8,660,903 B1

Design your trademark

Trademarks help us distinguish one person's product or service from another's. Trademarks are source identifiers! Trademarks can be words, designs, or a combination of such, but trademarks may take many other forms. Sounds, scents, shapes, and colors can also function as trademarks if they identify the source of a product or service. Think of a design, name, or symbol you would use to help the world recognize and distinguish the brand of your invention. Make sure that it is unique and not easily confused with other trademarks.

How will you distinguish your trademark so people know you are the source of your goods and services?

The binary broadcast

Background

Dr. Marian Croak is a visionary. In the early 1980s, she advocated transmitting telephone calls over the internet rather than through wired technology. A wired phone sends messages by analog signals: In this analog system, sound waves created by voice are converted to electrical signals, which are sent over wires to the receiver. When Dr. Marian Croak developed VoIP, she faced skepticism. It took time for scientists and engineers to support her inventions.

The internet is a system that moves information from one place to another. Computers cannot manage continuous analog signals, so communication instead takes digital form using a binary system code. This code can be transmitted quickly through electrical pulses.

A binary code is any code that uses two symbols to communicate information. One example of binary code is Braille, which uses two conditions: raised or flat dots. Morse code is another example of binary code that uses a system of long and short signals.

In computers, information is changed to a binary code using 1s and 0s, where different combinations of 1s and 0s represent letters, characters, numbers, and directions. This pair –1 and 0 – is known as a "bit." A bit is the smallest unit of information transmitted. "1" can also be represented by turning on the light, and "0" can be represented by turning off the light.

The *ASCII - Binary code character table on this page shows that each letter is assigned a number. The ASCII number is converted to binary code, an eight-digit sequence of ones and zeros. Words and data are transmitted across computer networks using this code.

***ASCII - Binary code character table**

Letter	ASCII Code	Letter	ASCII Code
a	097	**A**	065
b	098	**B**	066
c	099	**C**	067
d	100	**D**	068
e	101	**E**	069
f	102	**F**	070
g	103	**G**	071
h	104	**H**	072
i	105	**I**	073
j	106	**J**	074
k	107	**K**	075
l	108	**L**	076
m	109	**M**	077
n	110	**N**	078
o	111	**O**	079
p	112	**P**	080
q	113	**Q**	081
r	114	**R**	082
s	115	**S**	083
t	116	**T**	084
u	117	**U**	085
v	118	**V**	086
w	119	**W**	087
x	120	**X**	088
y	121	**Y**	089
z	122	**Z**	090

Convert your name to ASCII then to binary code

What is the difference between the ASCII number and binary code?
ASCII is the American Standard Code for Information Interchange, used to represent text in computers and other devices that use text. There are 128 possible characters in the standard ASCII set, with each character (letters, numbers, and punctuation marks) represented by a number.

Directions

1. Spell your first name in the first column of the chart below.
2. Find the ASCII code number for each letter of your name in the *ASCII - Binary code character table.

ASCII Code number for each letter of your name

Spell your first name (one letter per row going down)	**ASCII Code for each of the letter of your name**
Example: K	**075**

3. In the first column of the "Base 2 binary place value table" on the next page, place each letter of your name on a different row.
4. Now, for each letter of your name you will convert the ASCII Code number to binary code.

   Working across the row for each letter, place 1s or 0s so that the Base 2 place values above the 1s on the row add up to the ASCII code number.

   a. For example, if your name was ALICE, the table would look like this:

Base 2 → **Letter ↓**	**128** 2^7	**64** 2^6	**32** 2^5	**16** 2^4	**8** 2^3	**4** 2^2	**2** $2^{1e\,b}$	**1** 2^0
A: 065	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
L: 076	0	1	0	0	1	1	0	0
I: 073	0	1	0	0	1	0	0	1
C: 067	0	1	0	0	0	0	1	1
E: 069	0	1	0	0	0	1	0	1

Base 2 binary place value table

5. By adding up the Base 2 values with a 1 in their column, the total equals the ASCII code number:

   A: (64 + 1) = 065

   L: (64 + 8 + 4) = 076

   I: (64 + 8 + 1) = 073

   C: (64 + 2 + 1) = 067

   E: (64 + 4 + 1) = 069

6. "ALICE" in binary code is:

   A: 01000001

   L: 01001100

   I: 01001001

   C: 01000011

   E: 01000101

Base 2 binary place value table

Base 2 → Letter ↓	128 2^7	64 2^6	32 2^5	16 2^4	8 2^3	4 2^2	2 2^{1e} b	1 2^0
Example: K 075	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**1**

7. Write your name in binary code.

How do computers send messages using binary code?

Binary code consists of sequences of 0s and 1s, which correspond to the absence or presence of an electrical signal. This forms the language that computers use to process information. You will model how computers send and receive signals using a flashlight and tapping. The light will represent a 1 and a tap will represent a 0.

Directions

1. Use the light and tap method of communication to represent a 1 or 0.
2. Light the flashlight once to represent a 1. Turn it on twice to represent two 1s in a row.
3. Tap to represent a 0. Tap two times to represent two 0s in a row.
4. In the ASCII binary code character table, the letter H is assigned 072. When expressed in binary code (base 2 mathematically), the letter H is represented as: **01001000**

Base 2 → **Letter ↓**	**128** 2^7	**64** 2^6	**32** 2^5	**16** 2^4	**8** 2^3	**4** 2^2	**2** 2^1	**1** 2^0
H	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**

5. Work with a partner and use the light and tap method of communication to send the message "Hi."
6. In light signals, the sender will use the light and tap method to send the first letter:
   light off one tap **(0)**
   light on **(1)**
   light off two taps **(0,0)**
   light on **(1)**
   light off three taps **(0,0,0)**
   The receiver would write: **01001000**

Transmit the letter "i."

7. The next letter to transmit is "i" which is assigned ASCII number 105 according to the *ASCII - Binary code character table. In binary code (base 2 mathematically) the letter "i" is represented as: **01101001**

Base 2 → **Letter ↓**	**128** 2^7	**64** 2^6	**32** 2^5	**16** 2^4	**8** 2^3	**4** 2^2	**2** 2^1	**1** 2^0
i	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**1**

8. Using the light and tap method of communication, the sender will send the second letter:
   Light off one tap **(0)**
   Light on twice **(1,1)**
   Light off one tap **(0)**
   Light on **(1)**
   Light off two taps **(0,0)**
   Light on **(1)**

The receiver would write: 01101001

Send messages like a computer!

Your group will be assigned a card. One person in the group will be the sender and will send coded messages to the rest of the group using the light and tap method. Each member of the group will write down the binary code received and then will use the binary code table to interpret the message.

9. One member of your group, the sender, will be given a card with the binary code for each letter of a word. Do not show the group the name or picture on the front of the card.
10. The sender will transmit the message to their group, using the light and tap method of communication. The group will record the binary code message.
11. Group members will decode the message using the binary code character chart and write the letters represented by the binary code in the first column.

Base 2 → **Letter ↓**	**128** 2^7	**64** 2^6	**32** 2^5	**16** 2^4	**8** 2^3	**4** 2^2	**2** 2^1	**1** 2^0

12. The sender will turn over the card and show the group the picture and name so they can check their computer message.

How do computers work? How does the internet work?

Background

In this activity, you'll watch videos from code.org about how computers and the internet work.

Bill Gates introduces six short videos in the "How Computers Work" series. Each video features a different aspect of computer technology, including what makes a computer a computer, electrical signaling, circuits, and parts of the computer that input, output, store information, and code.

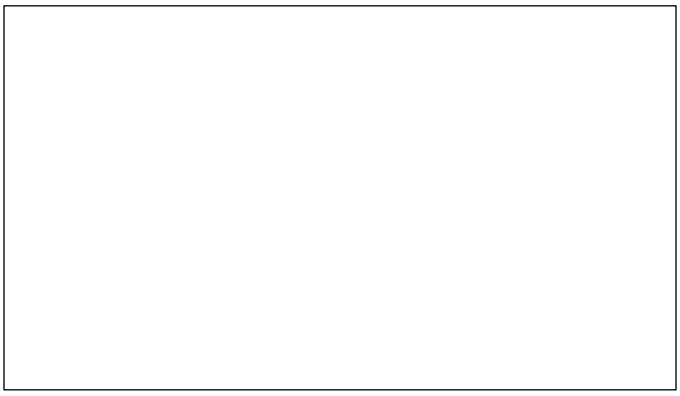
Vint Cerf, inventor of TCP/IP, and David Karp, founder of Tumblr, introduce the video series "How the Internet Works." Similar to the "How Computers Work" series, these videos describe various aspects of how the internet works.

Directions

1. Navigate to https://code.org/educate/resources/videosand watch the indicated videos on the note sheet from the "How Computers Work" series and the "How the Internet Works" series. Take notes as you watch each video.
2. Then, work in groups to compare and add to your notes.
3. Report to the larger class about a selected video.

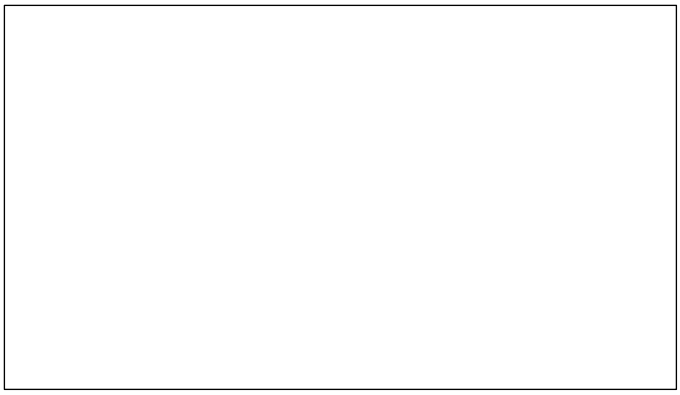
How computers work:

Introducing how computers work



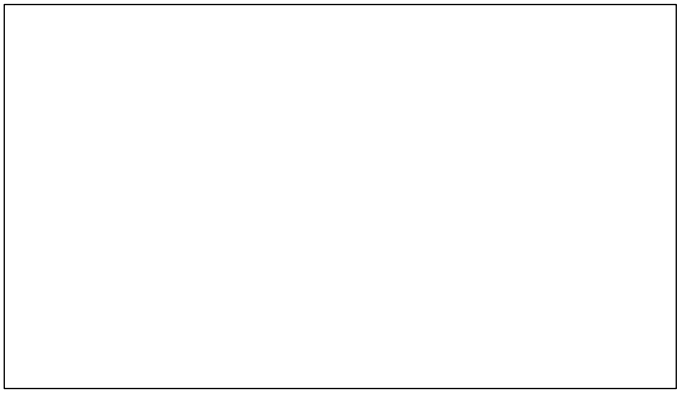
What makes a computer a computer?

Binary and data

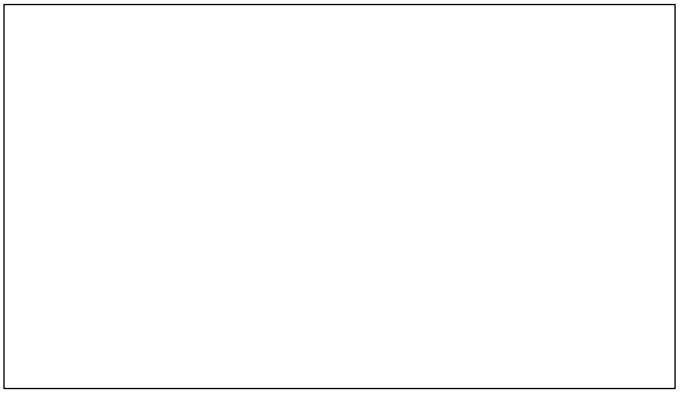


Circuits logic

CPU, memory, input, and output



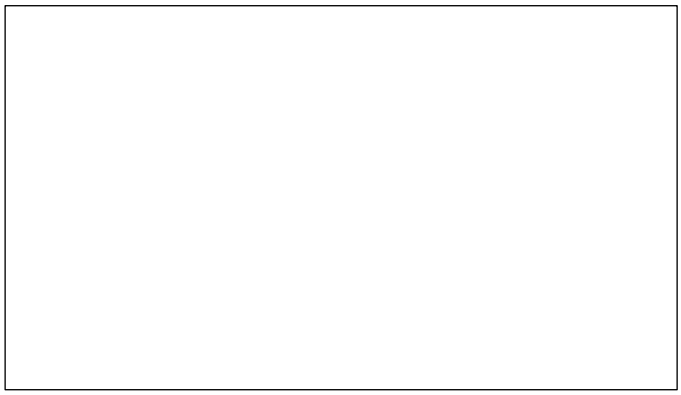
Hardware and software



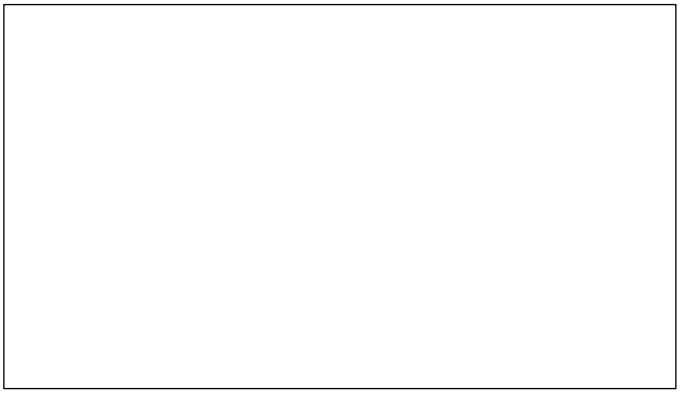
How the internet works

What is the internet?

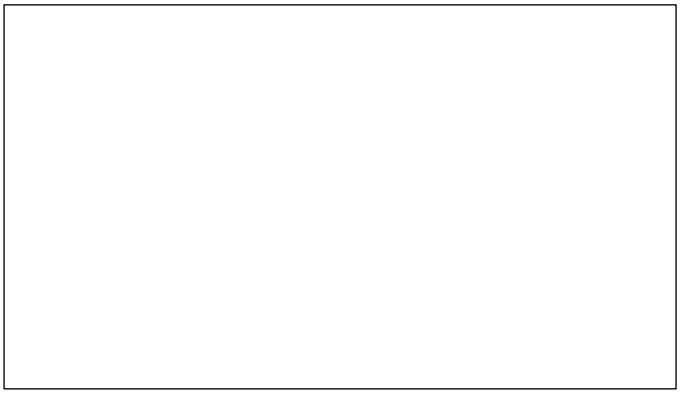
Wires, cables, and Wi-Fi



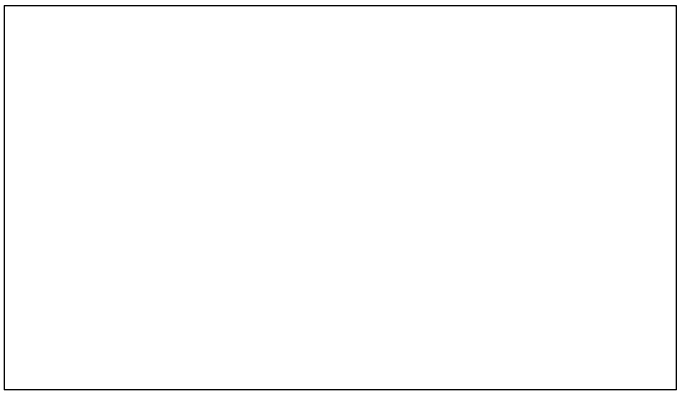
IP addresses and DNS



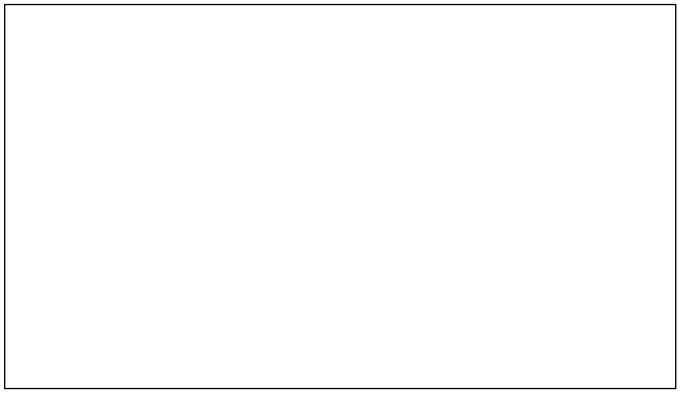
Packets, routing, and reliability



HTTP and HTML



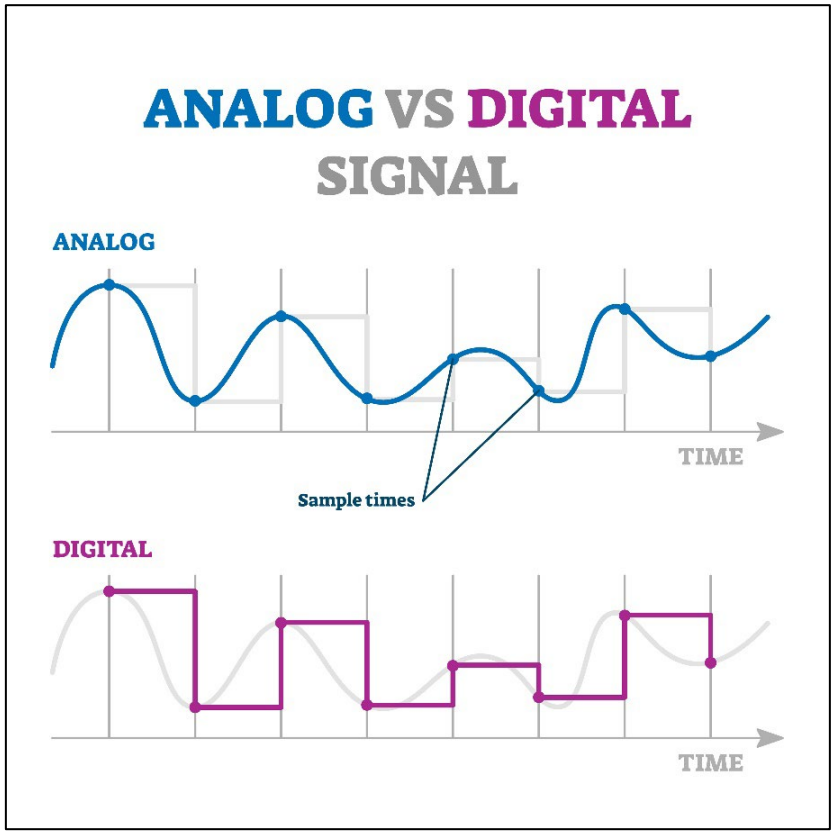
Encryption and public keys



How does Voice over Internet Protocol (VoIP) work?

Background

Computers process information through a set of instructions called binary code. Binary code is a two-symbol system of 1s and 0s, which represent "on" and "off." Digital signals are different from analog because each signal is separate, whereas analog signals are transmitted in a continuous wave. The diagram below shows the difference between analog and digital signals.



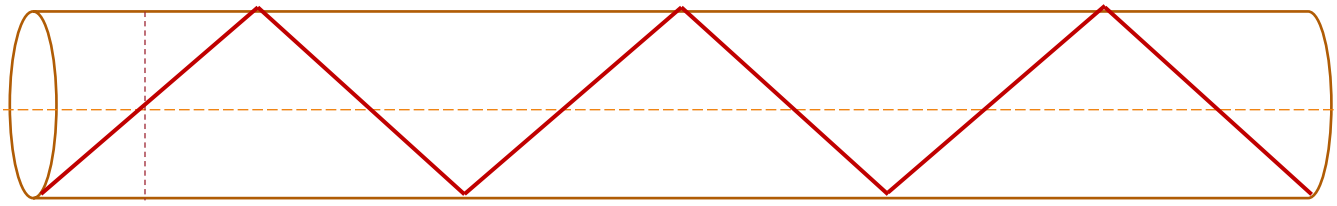
Information is sent from computer to computer via different pathways, including electrical, light, and radio waves. Each digital signal method varies depending on distance, speed, and convenience. A wired electrical system is always at either end of the pathway to interpret the digital signals. Initially, information sent and received online didn't allow the transmission of voice, images, music, or movies.

How fast can light travel?

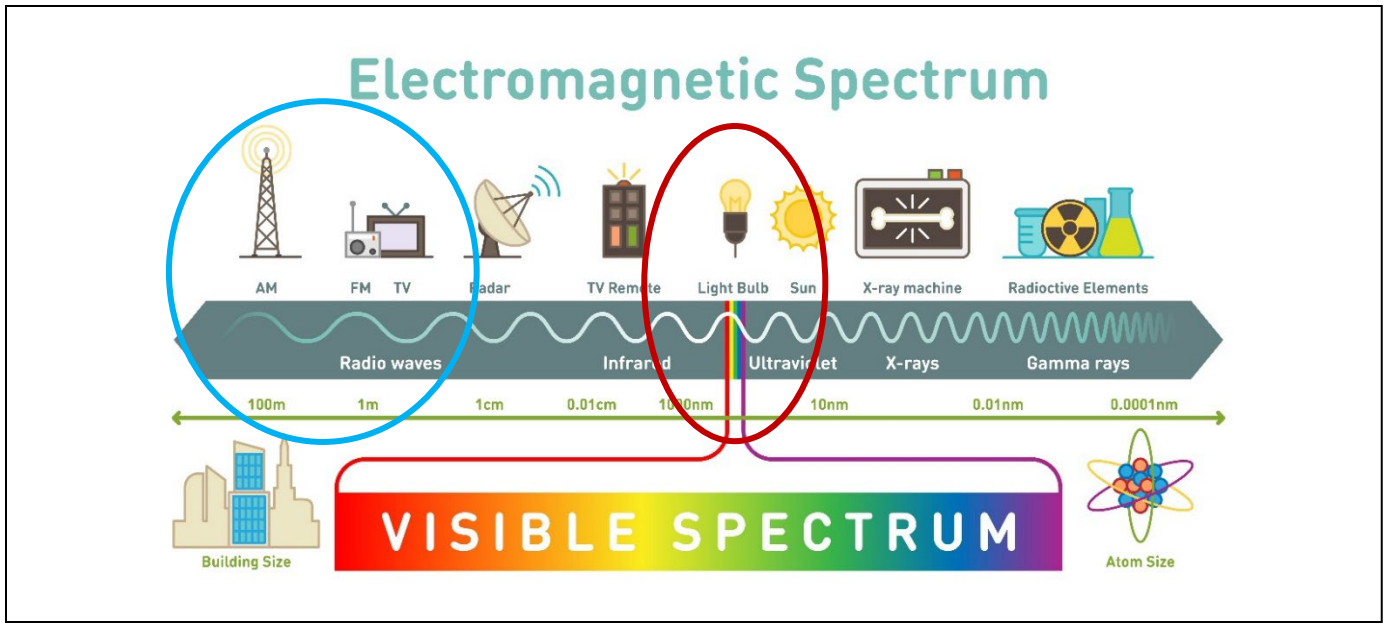
Light travels at a constant, finite speed of 186,000 mi/sec. The circumference of the earth is 24,091 miles. At the speed of light, how many times could you circumnavigate the equator in one second?

Fiber optic lines send digital messages via **light** through fiber optic cables. Depending on the angle of reflection, you can send multiple signals down the same cable, all at the speed of light, across long distances. Fiber optic lines allow transmission across the ocean and around the world.

Light traveling along the fiber optic cable must start at an angle greater than the critical angle, which is 90 degrees.

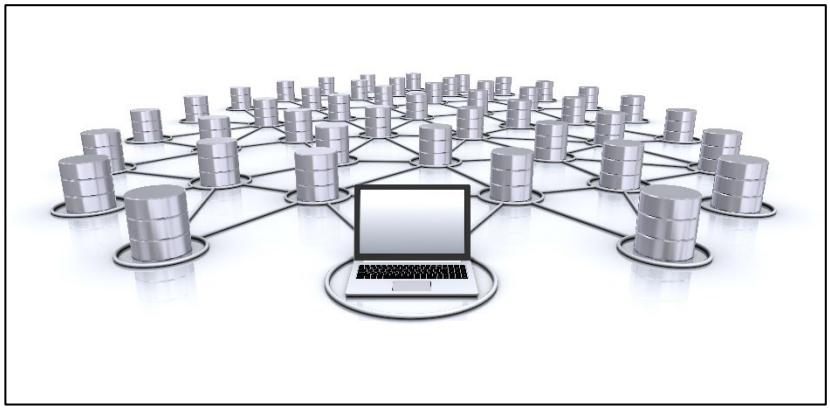


Radio and light waves have different frequencies, as shown in the diagram below.



Radio waves allow wireless transmission across much shorter distances; for example, from one room in your house to another, within a community, or on an airplane. Machines convert binary code to radio waves of different frequencies.

Bandwidth measures the amount of information transmitted over the internet in a specific period of time. Images, voice, and video require a lot of bandwidth to send. Data is sent in "packets" to maintain reliability and speed of transmission.



Dr. Marian Croak invented a way to send voice over the internet **(VoIP)** by enabling the transmission of digital information through internet protocol "packets." Internet protocol is a set of rules for how data packets or smaller pieces of information move across networks and reassemble on the receiving end. Sending data in packets maintains reliability and speed of transmission. Larger audio and video files can be transmitted much faster through data packets.

Packets travel in a route similar to how you travel in a car. Depending on highway traffic, you might take a different path to get to your destination faster. If there is an accident up ahead, you might take another road. When there's too much internet traffic, routers can redirect the internet protocol packet and find more efficient lines of transmission.

In the next activity, you will work in a team to demonstrate how packets take different paths and reassemble before output on the receiver's computer or device.

Information speedway game

Voice, pictures, and movies move across the internet in packets. Using packets to send data results in faster and more stable internet transmission.

Directions

1. Start the timer before team members draw their first card.
2. Select a jigsaw puzzle game piece. Everyone will simultaneously move game pieces across the transmission field (board), from a desktop computer to a laptop. One team member will put the puzzle together on the receiving side of the board.
3. Draw a router card and move the puzzle piece along the path to the colored router on the board. Put the card on the bottom of the packet card pile.
4. If you cannot move directly to a router on the board, draw again until you have drawn a card for a router with a direct path. This means there was high traffic and an alternate path was needed.
5. Draw a second card and continue to move the puzzle piece along the path. Keep drawing cards and moving puzzle pieces until they reach the other side of the board.
6. Select another jigsaw puzzle game piece and repeat steps 1-6 until all the pieces are on the receiving side of the laptop.
7. The assigned team member will assemble the pieces as the team transmits all game pieces to the board's receiving laptop side.
8. Stop the timer once your group completes the image. Record the team time.

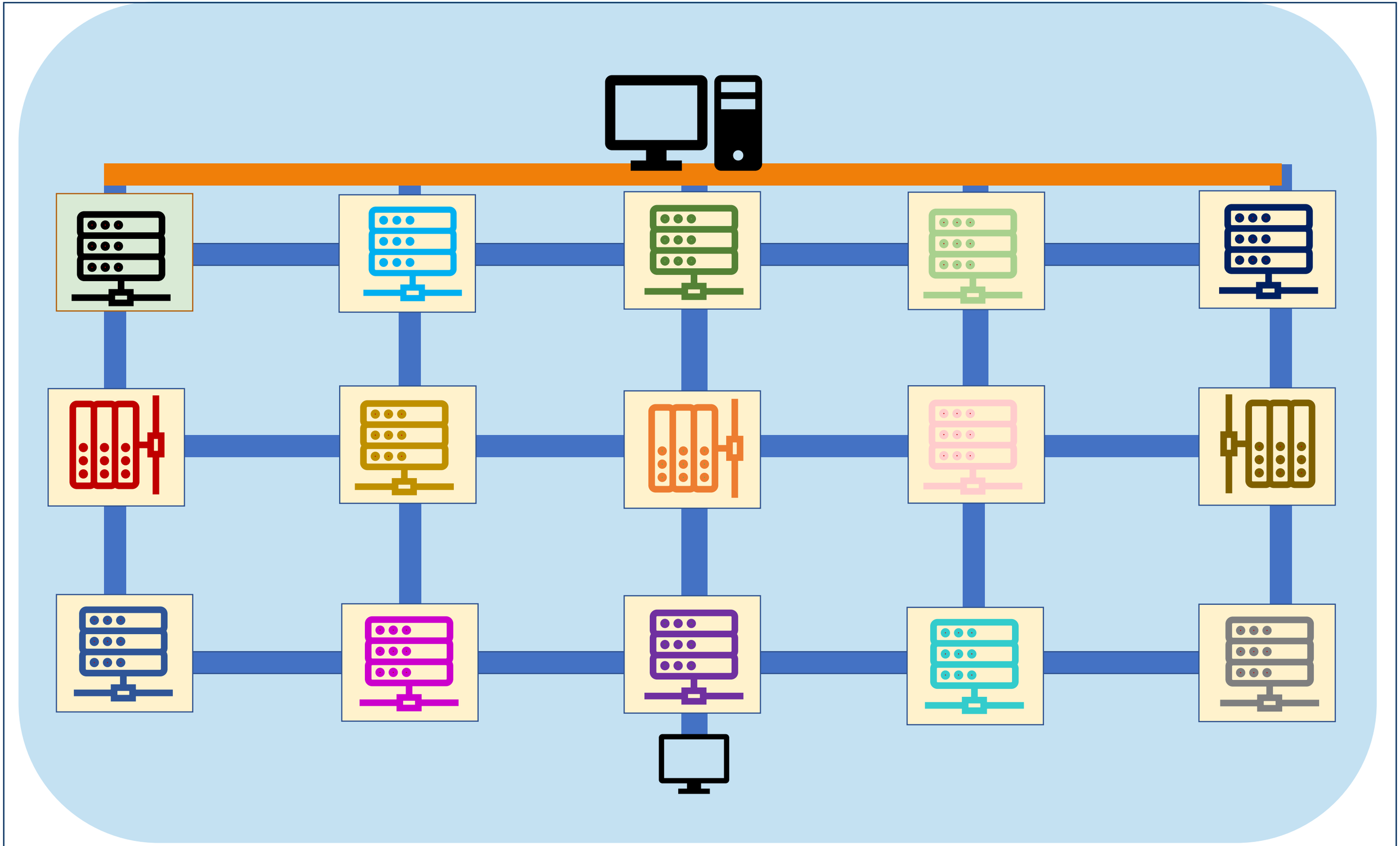
TEAM	Time trial 1	Time trial 2
Number 1:		
Number 2:		
Number 3:		
Number 4:		

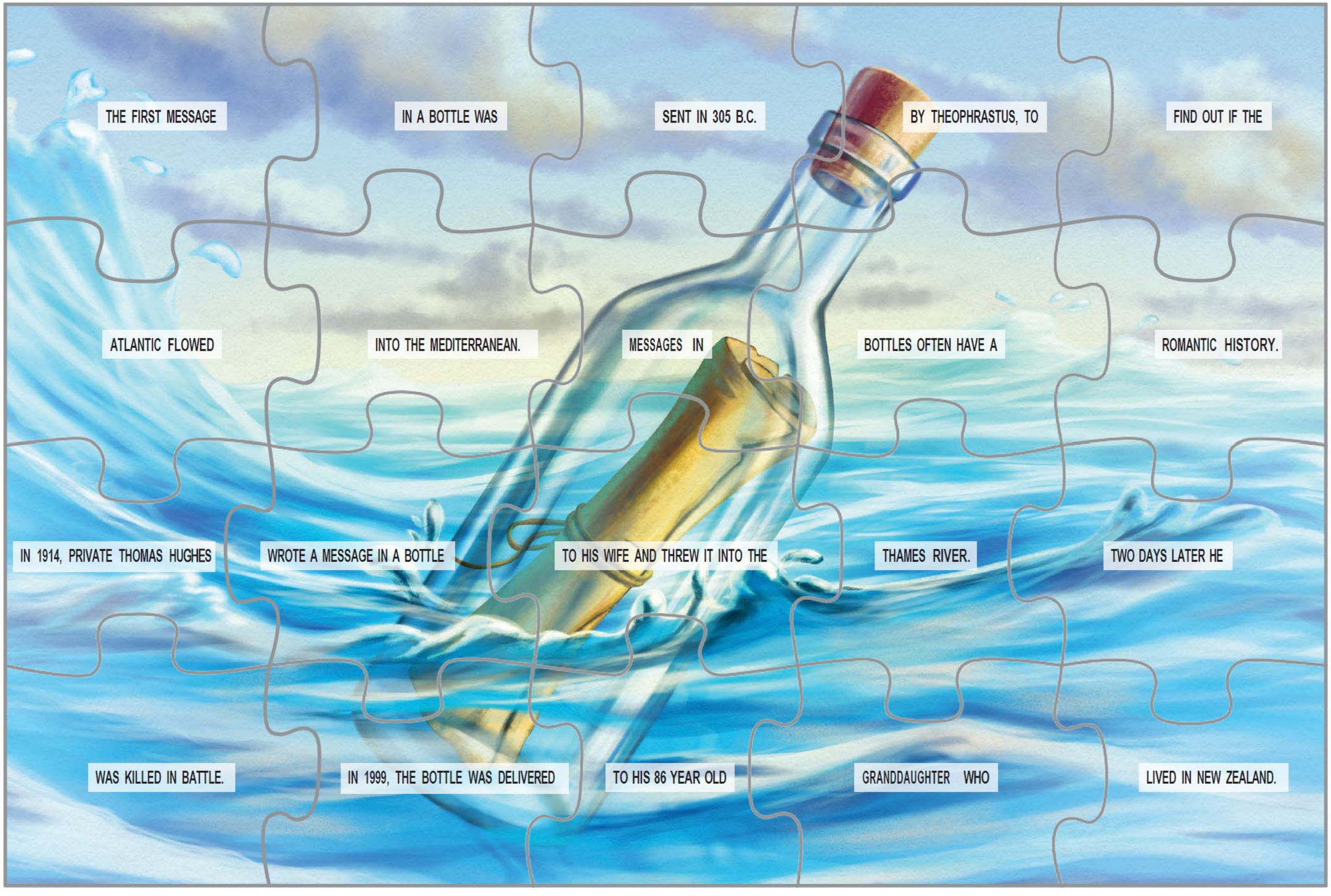
Observations

Questions

1. What happens to an image, voice, or movie if all the packets are not transmitted?
2. How is an analog transmission different from a digital transmission?
3. Review one of the 200 patents of Dr. Marian Croak. What technologies do you use today that

Cut out each of the cards and the puzzle pieces.




THE FIRST MESSAGE
IN A BOTTLE WAS
SENT IN 305 B.C.
BY THEOPHRASTUS, TO
FIND OUT IF THE
ATLANTIC FLOWED
INTO THE MEDITERRANEAN.
MESSAGES IN
BOTTLES OFTEN HAVE A
ROMANTIC HISTORY.
IN 1914, PRIVATE THOMAS HUGHES
WROTE A MESSAGE IN A BOTTLE
TO HIS WIFE AND THREW IT INTO THE
THAMES RIVER.
TWO DAYS LATER HE
WAS KILLED IN BATTLE.
IN 1999, THE BOTTLE WAS DELIVERED
TO HIS 86 YEAR OLD
GRANDDAUGHTER WHO
LIVED IN NEW ZEALAND.

What have you learned?

1. What is binary code?

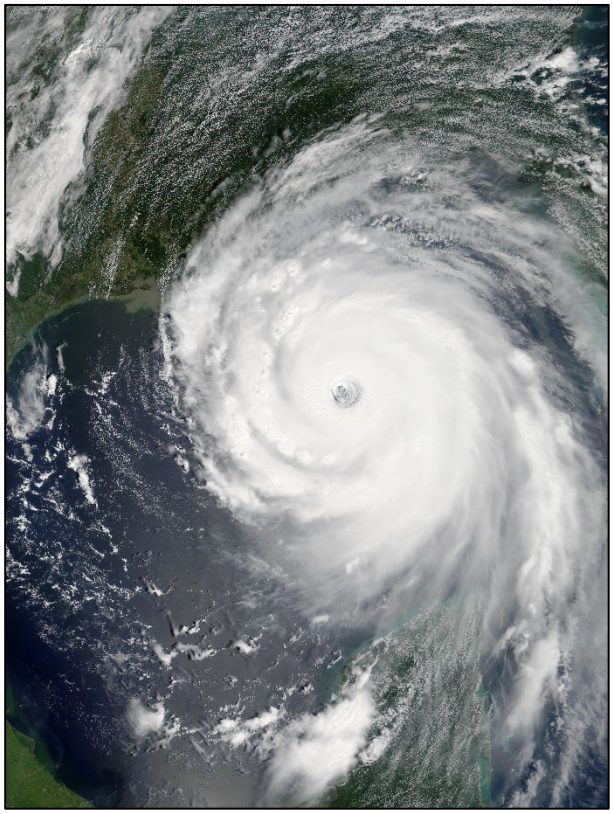
2. How do you determine binary code mathematically?

3. What is the difference between analog and digital signals? Which works best for computers to send data? Explain.

4. Why must large sets of information travel in packets from one device to another?

5. How did the technology Marian Croak invented and patented enable us to work the way we have in recent years, especially during the COVID-19 pandemic?

Using technology to help others



In 2005, Louisiana experienced one of our nation's most devastating natural disasters. Hurricane Katrina, a Category Five storm, struck New Orleans on August 23 and caused more than 1,800 deaths and $125 billion in damage. In response, Dr. Marian Croak developed technology that allowed people to securely donate to charitable causes using text messaging. Dr. Croak was inspired by a talent show called *American Idol* that used texting to collect votes from the audience to determine the most popular performances.

Dr. Marian Croak filed a patent for her text-to-donate invention in 2005. This invention was just one way Dr. Croak has used technology to help people in need.

What innovative ways can you think to solve a problem or help others solve a problematic situation using technology? Use the box below to answer this question.

Some ideas could include but are not limited to:

- How to keep toddlers safe
- Help senior citizens keep track of important documents
- Connect non-technological people to others who can help them make medical appointments
- Support teenagers who have a difficult time socializing with others

Select your idea and use your inventor's notebook to develop your invention.

Appendix I

Coding cards for the binary broadcast activity

Coding cards

Bear

01000010

01100101

01100001

01110010

Horse

01001000

01101111

01110010

01110011

01100101

Appendix II

ASCII Code – Character to Binary for Binary broadcast activity

ASCII Code - Character to Binary

0	0011 0000	I	0100 1001	b	0110 0010	v	0111 0110
1	0011 0001	J	0100 1010	c	0110 0011	w	0111 0111
2	0011 0010	K	0100 1011	d	0110 0100	x	0111 1000
3	0011 0011	L	0100 1100	e	0110 0101	y	0111 1001
4	0011 0100	M	0100 1101	f	0110 0110	z	0111 1010
5	0011 0101	N	0100 1110	g	0110 0110		
6	0011 0110	O	0100 1111	h	0110 1000	:	0011 1010
7	0011 0110	P	0101 0000	i	0110 1001	;	0011 1011
8	0011 1000	Q	0101 0001	j	0110 1010	?	0011 1111
9	0011 1001	R	0101 0010	k	0110 1011	·	0010 1110
		S	0101 0011	l	0110 1100	'	0010 1111
		T	0101 0100	m	0110 1101	!	0010 0001
A	0100 0001	U	0101 0101	n	0110 1110	'	0010 1100
B	0100 0010	V	0101 0110	o	0110 1111	"	0010 0010
C	0100 0011	W	0101 0111	p	0111 0000	(	0010 1000
D	0100 0100	X	0101 1000	q	0111 0001	)	0010 1001
E	0100 0101	Y	0101 1001	r	0111 0010	space	0010 0000
F	0100 0110	Z	0101 1010	s	0111 0011		
G	0100 0111			t	0111 0100		
H	0100 1000	a	0110 0001	u	0111 0101		