What Is Bluetooth?

How Does It Differ from a Wired Connection?

What Is Bluetooth? Pre-Quiz

1. **What is an electrical connection?**

2. **Give an example of a wireless electrical connection.**

What Is Bluetooth? Pre-Quiz Answers

1. **What is an electrical connection?**

   The link that allows electricity to pass between two or more devices.

2. **Give an example of a wireless electrical connection.**

   Example: **The link between a remote control garage door opener and the motor that raises the garage door.**

What Are Electrical Connections and What Is Bluetooth? (50 minutes)

Our Wireless World

In the age of the internet and cell phones, wireless communication is everywhere. Wireless channels of communication make it possible for electrical devices to send and receive messages almost instantly.

For instance, wireless communications help emergency responders and saves lives! It is important to have a basic understanding of how wired and wireless communications work.

Objective

To look at how a wireless connection type known as Bluetooth can be used to control LEGO robots remotely from android devices.

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What Is an Electrical Device?

An electrical device is a device powered by electricity.

Common electrical devices include:

- TVs
- game systems
- computers
- microwaves and ovens
- light bulbs

Electricity and electrical devices are everywhere!

How Is Electricity Used in Electrical Devices?

- **Electricity must travel** from the source (such as a battery) to the device.

- For example, when a light switch is flipped on, the light turns on. *How did the light turn on by just turning on a switch?*

- Electricity travels to the light bulb once the switch is turned on and provides the light bulb with energy to light up. *How does electricity travel?*

- Electricity travels through wire, which acts as electrical connections between light switches and light bulbs.

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What Is an Electrical Connection?

An **electrical connection** is the link that allows electricity to pass between two or more devices.

Examples of types of connections:

- A toaster connected with a cord and plug
- Cell phone-to-cell phone connections
- A garage door opener remote with a garage door
- A PS3 controller with a PS3
- A connection to the internet from a faraway laptop
- An iPod connected with a computer (for charging or downloading music)

Classification of Electrical Connections

Two types of electrical connections:

Wired connections: In 1838, Samuel Morse demonstrated the telegraph, which made it possible to send a series of electrical pulses over wires. These signals were interpreted by skilled telegraph operators as messages.
→ *This technology was the beginning of wired communications!*

Wireless Connections: When computers communicate "via the air waves," and without physical media like wires and cables, that communication is considered "wireless." The challenges to string wire over long distances and immovable physical obstacles can be overcome via wireless connections.

Do This: Fill out worksheet Part 1 about topics we have covered so far.

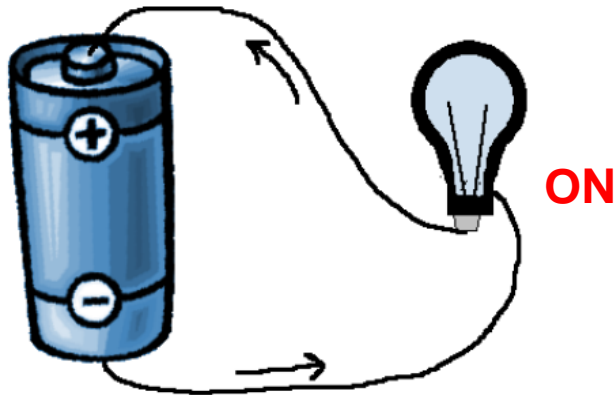Next, we'll look at wired communications and its origins.

How do you think messages were transmitted over wires in the early 1900s?

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Idea of a Code for Messages

⬇ **In this scenario, ON, can be taken as a state and OFF as another state.**

Simple Circuit

ON

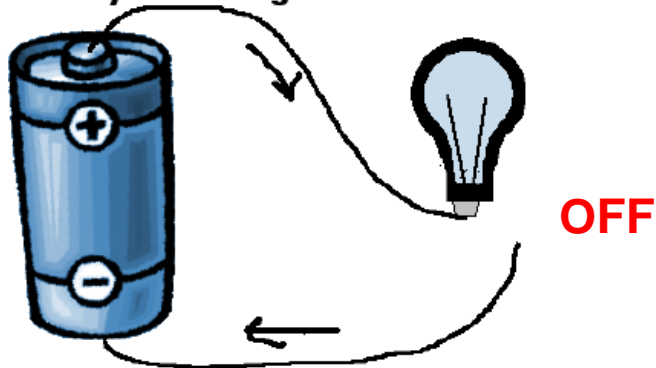**Simulating a Simple Switch by Removing the Wire**

OFF

Can you make a code using these ON and OFF states?

In 1834, this is exactly what Morse did, and the Morse code was born!

The code can work with light being on and off, or sound being on and off, etc. That is, anything that has two states can be used.

To transmit such codes over long distances using wires, electrical bursts are turned on and off using special devices called Morse code transmitters – they essentially acted as switches, as shown in the diagram on the left.

↖

Morse Code

Over long wires that formed a circuit, a device was invented to switch the circuit ON and OFF, and a code was developed for messages!

⬅**This U.S. model, the J-38, was made in huge quantities during World War II, and remains in widespread use today.**

The signal is "on" when the knob is pressed, and "off" when it is released.

Length and timing of the dots and dashes are entirely controlled by the operator.

How do we make a code for words using ON and OFF?

What about a code with "ON-gap-OFF" representing "A", and so on…?

Can we come up with such codes for all letters, and then use that to form words? That is exactly what Morse and his team did in the 1830s!

They used DOTS and DASHES. Next, let's look at that code.

International Morse Code

1. The length of a dot is one unit.
2. A dash is three units.
3. The space between parts of the same letter is one unit.
4. The space between letters is three units.
5. The space between words is seven units.

Morse Code

Examples:

(note: / is used between words)

1. "**Hello**" in Morse code is

.... . .-.. .-.. ---

2. "**How are you?**" is

.... --- .-- / .- .-. . / -.-- --- ..-

Do This:

Write out the Morse code for the following phrases:

1. "This is fun"

2. "Thank you"

3. "I love you"

4. "Move on"

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Morse Code (continued)

Morse code uses DOTS and DASHES for ON and OFF.

Morse Code Rules:

- **The length of a dot is 1 unit, and a dash is 3 units**
- **The space between parts of the same letter is 1 unit, while the space between letters is 3 units**
- **The space between words is 7 units, but here we use the symbol "/" for space between words**

Examples:

"Hello" in Morse code = ...-.. .-.. ---

"How are you" = ... --- .-- / .- .-. . / -.-- --- ..-

Do This: Write out the Morse codes for the four messages (on your worksheet and the previous slide) **using the codes for each letter in the alphabet chart.**

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Morse Code Answers

Answers:

"This is fun"
- .... / .. ... / ..-. ..- -.

"Thank you"
.... .- -. -.- / -.-- --- ..-

"I love you"
.. / .-.. --- ...- . / -.-- --- ..-

"Move on"
-- --- ...- . / --- -.

Morse code is a simple way of **transmitting information through a wired connection**!

We have many other advanced codes now to transmit via telephone wires, cable, etc., but **the idea of a CODE** is still the same. You just have to check what CODE the particular wired connection uses.

For instance, in a telephone wire, a person's voice is code and then transmitted, and at your end it is "decoded" to become sound again!

So, sound is coded into electrical signals, sent over wires, and then decoded into voice at the other end. That is how you hear in a telephone!

Use this website to translate text into Morse code (and hear how it sounds):
http://morsecode.scphillips.com/jtranslator.html

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Morse Code (continued)

←Morse code can also be transmitted using light as shown in the picture to the left in which a U.S. Navy seaman sends Morse code signals in 2005.

To do this, light ON could be like a dot and light OFF could be like a dash.

Many experts can send such codes using light!

Similarly, it can be transmitted using sound also.

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Back to Wireless Connections

In **wireless communication**, no physical connections exist—the message information **is transmitted via waves that travel through the air**.

Requiring no wires or cables makes messaging over long distances, rivers, oceans, etc., no problem!

Wireless transmissions also use different types of codes, which you will study in later classes.

Next, let's do a quick review of wired and wireless devices→

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Review: Wired or Wireless?

Match the connections to wired or wireless

Cell phone connections with other cell phones

A garage door opener remote with a garage door

A PS3 controller with a PS3

A toaster connected with a plug

An iPod connected with a computer (for charging or downloading music)

○ **Wired Connection**

○ **Wireless Connection**

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Answers: Wired or Wireless?

Match the connections to wired or wireless

Cell phone connections with other cell phones

A garage door opener remote with a garage door

A PS3 controller with a PS3

A toaster connected with a plug

An iPod connected with a computer (for charging or downloading music)

○ **Wired Connection**

○ **Wireless Connection**

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Types of Wireless Connections
And their Different Ranges

Let's focus on wireless connections and learn about some types of wireless connections and how they work.

Examples	Connection Range
Garage door opener remote	25-100 feet
Cell phone with other cell phone	In different areas, depending on phone company
Nintendo Wii remote with Wii	Approximately 10-30 feet, depending on wii
Bluetooth device with other Bluetooth devices	Ranges from 1-100 meters

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What Is Bluetooth?

- **Bluetooth** is a type of wireless electrical connection used for communication between two devices.

- Many electrical devices use Bluetooth:

  - Bluetooth cell phones

  - Bluetooth headphones

  - Nintendo Wii uses a Bluetooth connection from the Wii remote to the Wii

Why Do We Need Wireless Connections?

- **Bluetooth and other wireless connections allow devices to share information.**

- **Computers need to send and receive information from other computers all the time.**

- **Examples: Any time you receive an email, SMS text message, or use a social networking site, the information is sent through wireless connections from between computers and/or mobile phones.**

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Bluetooth with NXT

- **LEGO® MINDSTORMS® NXT robots use wireless Bluetooth connections much the same way.**

- **Just like other devices, the NXT can send text messages through Bluetooth.**

- **Example: If you are worried about an intruder coming into your room, you could program the NXT to use the ultrasonic sensor to "watch" your room's door. If the ultrasonic sensor detected that the door moved, the NXT could send you a message saying "intruder alert."**

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Bluetooth with NXT (continued)

- **The NXT can also receive messages through Bluetooth channels.**

- **This makes it possible to remotely control an NXT robot using another device (another NXT, a mobile phone or a computer) as the controller.**

- **During the next class, we will perform an activity where you will learn to control a LEGO robot using an android device using Bluetooth communications.**

What Is Bluetooth? Post-Quiz

1. **What is an electrical connection?**

2. **Give an example of a wireless electrical connection.**

What Is Bluetooth? Post-Quiz **Answers**

1. **What is an electrical connection?**

   The link that allows electricity to pass between two or more devices.

2. **Give an example of a wireless electrical connection.**

   Example: **The link between a remote control garage door opener and the motor that raises the garage door.**

Vocabulary

electrical connection: The physical link (conductor) that carries electricity between two or more devices.

Bluetooth: The brand name for a type of wireless electrical connection used for passing messages between two electronic devices.

Images Sources

Slides 1, 22: Bluetooth logo; source: 2011 Jnmasek, Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Bluetooth.svg

Slide 2: Bluetooth cell phone headset; source: 2004 Ed g2s, Wikimedia Commons: http://commons.wikimedia.org/wiki/File:Bluetooth_headset.jpg

Slide 9: circuit diagrams by author

Slide 10: telegraph key photo; source: 2007 Lou Sander, Wikimedia Commons: http://commons.wikimedia.org/wiki/File:J38TelegraphKey.jpg

Slide 11: international Morse code chart; source: 2008 U.S. Copyright Office via Wikimedia Commons http://commons.wikimedia.org/wiki/File:International_Morse_Code.svg

Slide 14: U.S. seaman sends Morse code; source: 2005 Tucker M. Yates, U.S. Navy via Wikimedia Commons http://commons.wikimedia.org/wiki/File:Seaman_send_Morse_code_signals.jpg

Slide 19: Six devices connected to chargepod multi-device charger hub; source: http://www.techgadgets.in/misc-gadgets/2007/21/callpod-chargepod-a-multi-device-charger-announced/ and CallPod Mobile Necessities http://www.callpod.com/products/chargepod

Slide 22: Android robot logo; source: 2009, Google http://en.wikipedia.org/wiki/File:Android_robot.svg