

# technocamps



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# Networks and Communication



# What is a Network?

A network is a group of connected things that can share information.

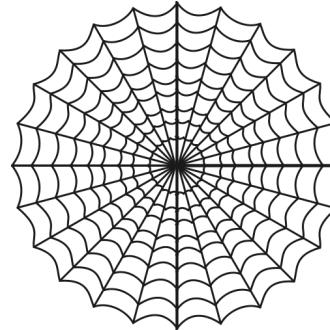
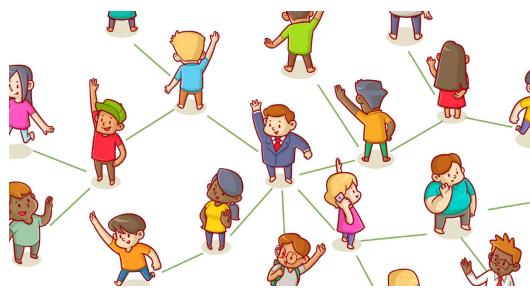
Right now, everyone in this room is a sort of network and we can pass information around by talking to each other.



# Types of Network

Networks can come in many forms.

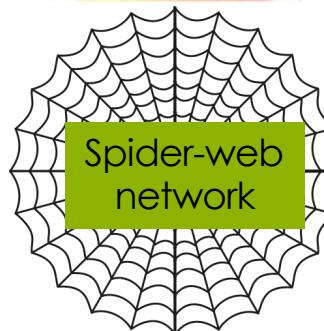
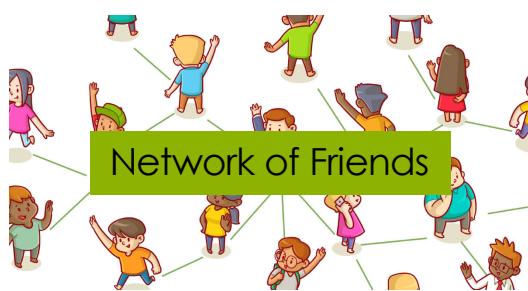
Can you think of any examples that could link to each of these photos?



# Networks

Networks can come in many forms.

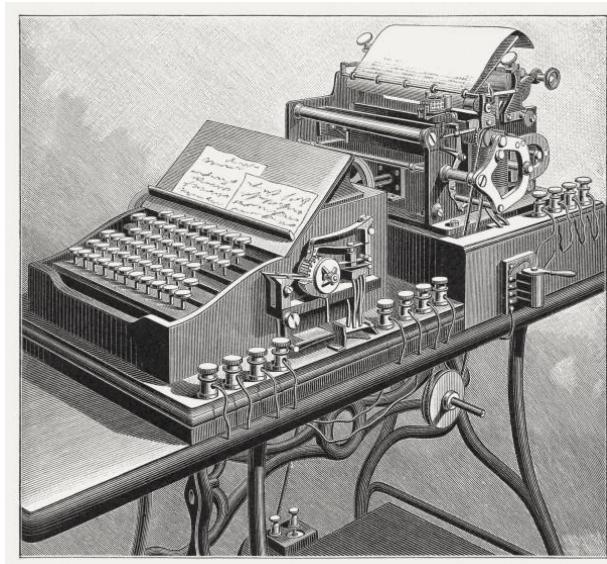
Can you think of any examples that could link to each of these photos?



# Early Communication Networks

Early communication networks included

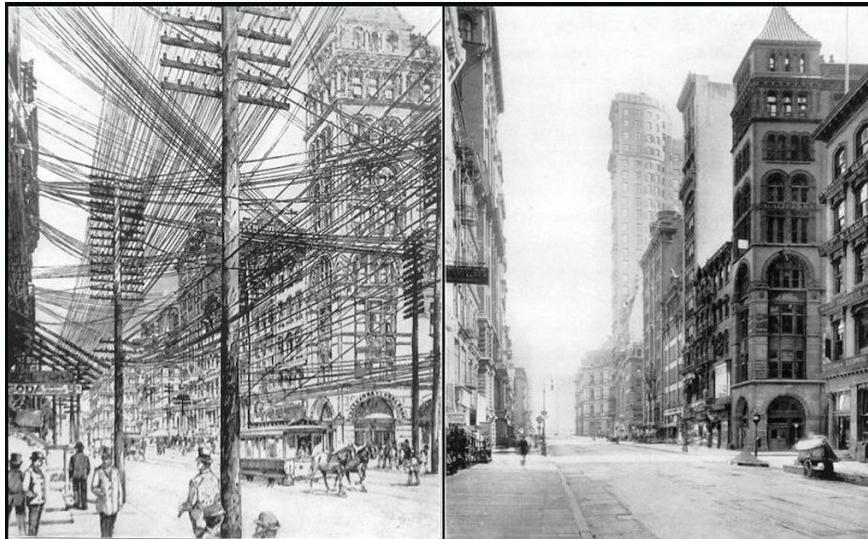
- Telegram
- Telephone
- Radio

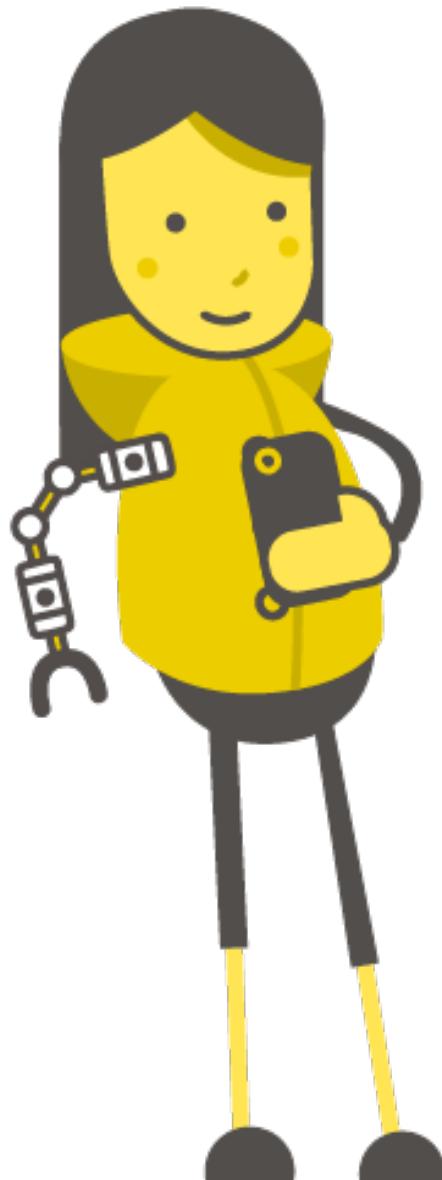


# Telegram and Telephone

Both the telegram and telephone connected the world with instant communication, this changed the world and was something never achieved before.

However they did require a wired connection to every device in every office and every home! This quickly became a problem.



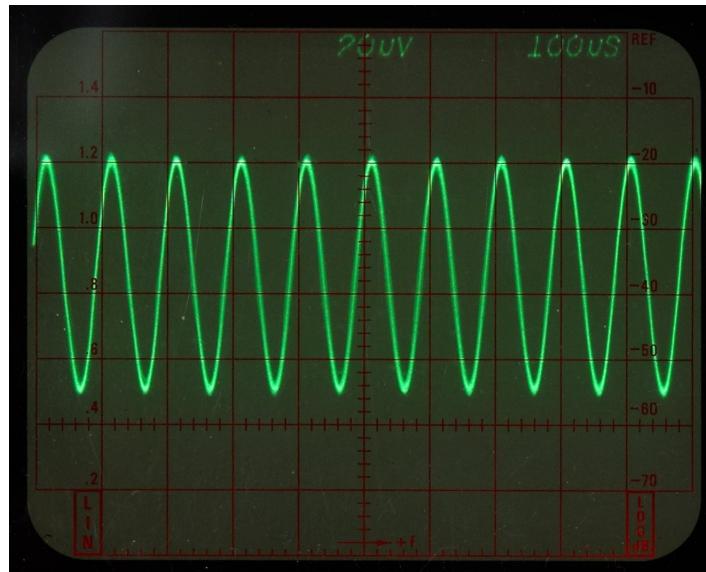


# Activity: Cup Phones

# Activity: Cup Phones

Both the telegram and telephone are devices connected by wires. Down these wires we send an electrical signal to communicate our information.

This signal is sent as an electrical wave.



# Activity: Cup Phones

Waves are used to carry all of our signals, from electricity to light and sound, and even vibrations.

We can make a basic telephone by connecting two cups with string.

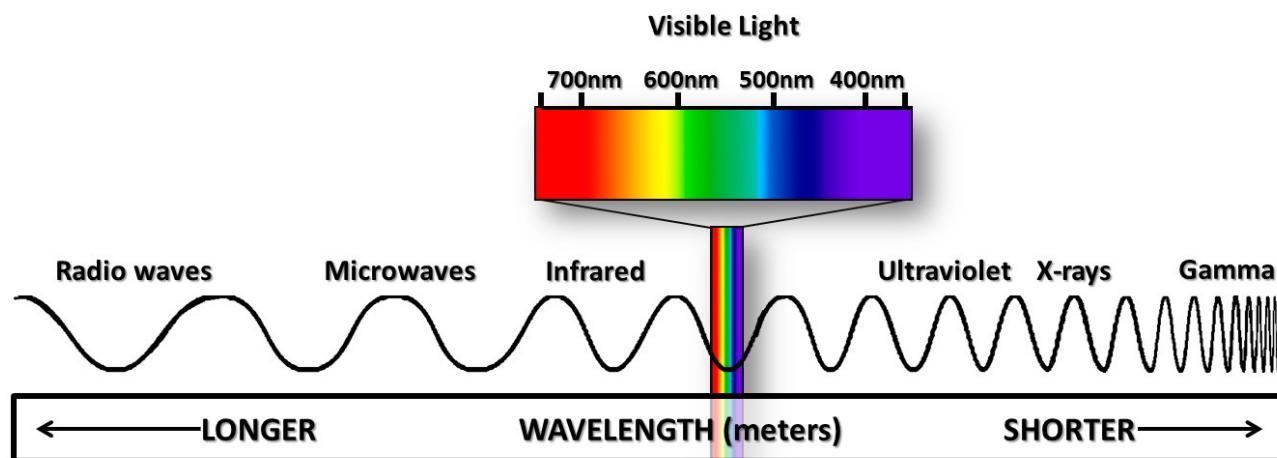
Pulling the string tight will allow the sound to travel through the string as a vibration!



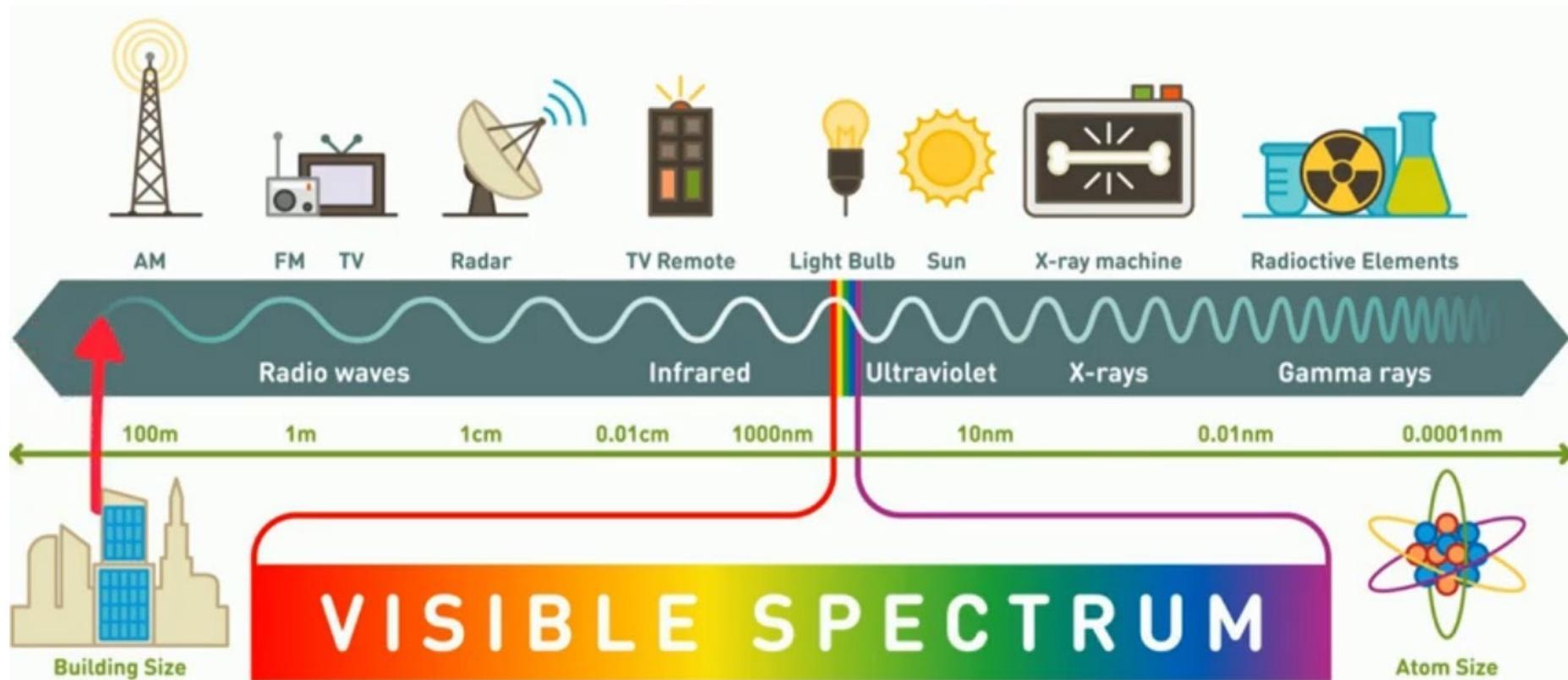
# EM Waves

Waves come in all shapes and sizes, most of which we can't see or feel in any way!

Many of these waves are part of the EM Spectrum, which means they are made of light, but as humans we can only really see a small bit of that light!



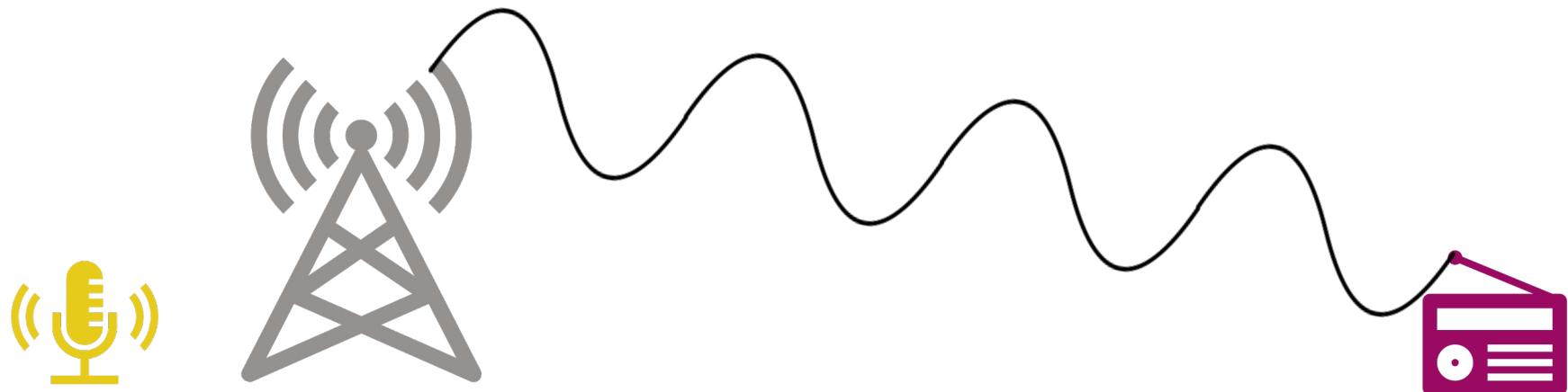
# EM Waves



# Radio

Radio is able to communicate over great distances using “radio waves” which are invisible to our eyes.

Radio is used for broadcasting music across the world, but also walkie-talkies, truck and police radios and more!



# Computer Networks

There are 3 ways we can get computers and phones to connect to the internet:

- Ethernet
- Wi-Fi
- Mobile network



# Ethernet

Ethernet is a type of wired computer network normally used in offices; it needs cables to connect to everything, which means it uses electrical waves.

It is the oldest of the three.



# Wi-Fi

Wi-Fi is the wireless technology used to connect devices to the internet, it uses shorter radio waves to connect devices but it isn't very powerful and has a short range.

The shorter waves means that more information can be sent!



# Mobile Network

Mobile networks are like Wi-Fi as you don't need cables, but they use even shorter waves and are more powerful meaning the signal can travel much further.



# Is More Power Dangerous?

We tend to think of something more powerful as being more dangerous, so that's the same for radio waves, right?

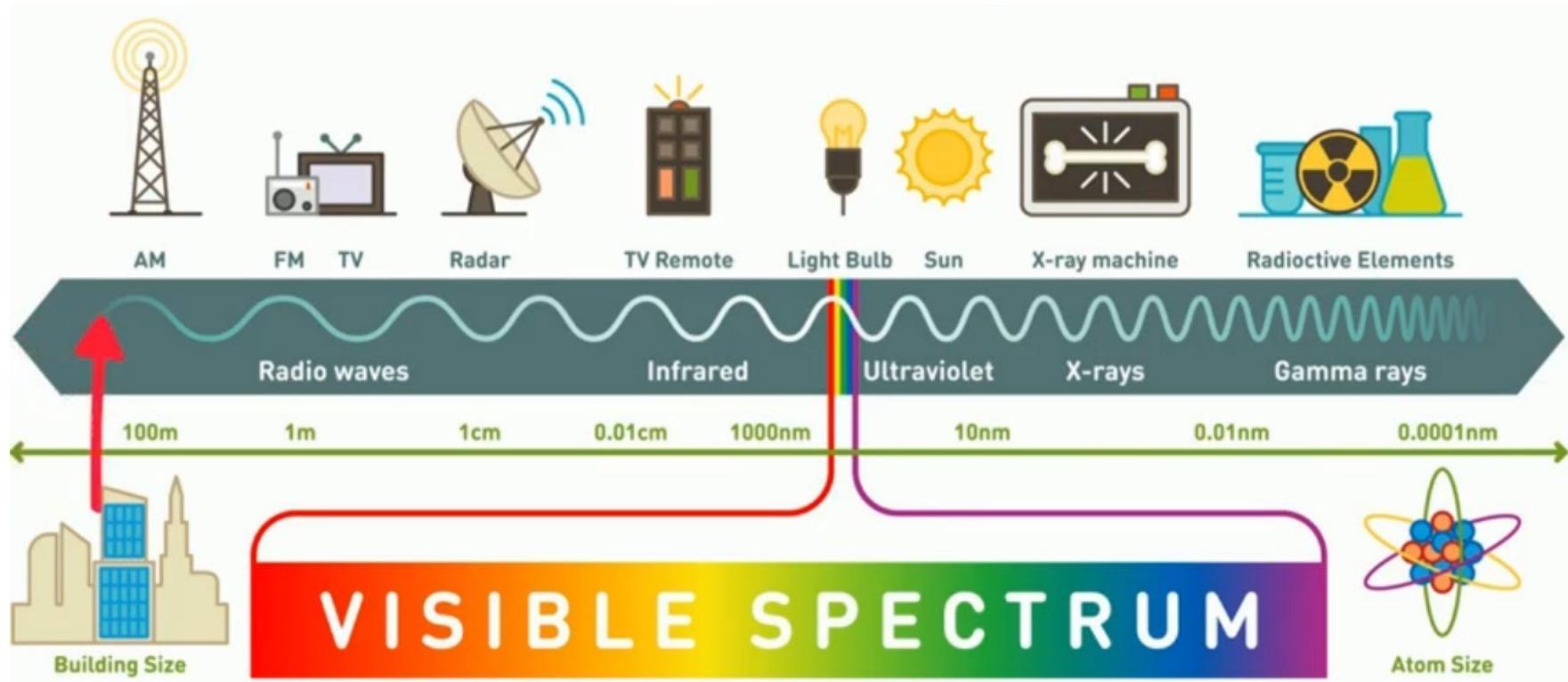
Well radio waves aren't really able to hurt or affect us in the first place, so making them more powerful doesn't really have any effect.

Light is a more powerful wave than radio, but does your TV hurt you?



# Is More Power Dangerous?

Longer waves have less energy, which means only those waves shorter than visible light can be dangerous to us!





## Activity 2: Data Race

# Data Race

We're going to try sending some information to each other using waves, similar to how a computer network would send information through waves.

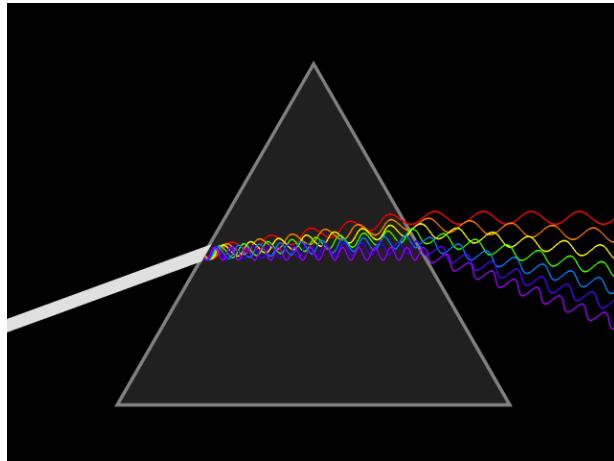
Can anyone think of any types of waves we can use?

# Data Race

We're going to try sending some information to each other using waves, similar to how a computer network would send information through waves.

Can anyone think of any types of waves we can use?

Light



Sound



# Data Race – Light

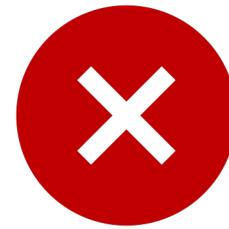
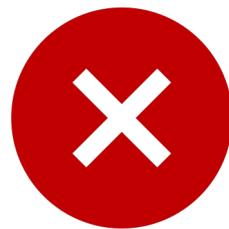
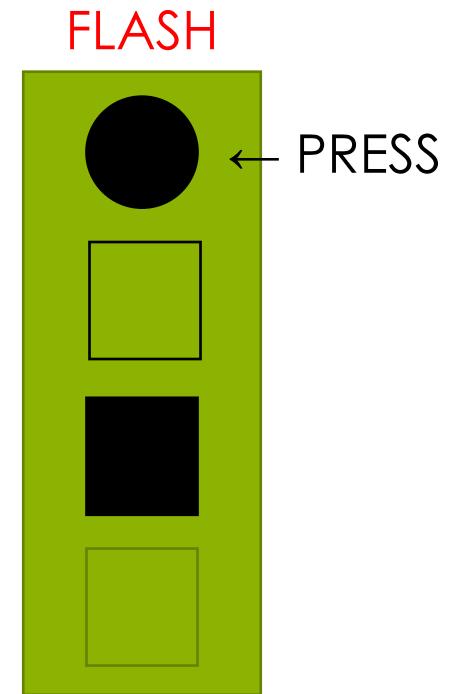
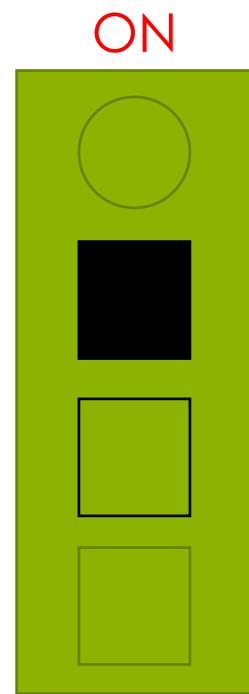
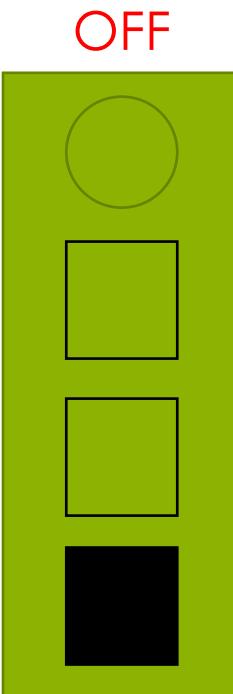
Firstly, we're going to try to communicate to between groups using light!

We will split our groups into two categories:

- The transmitter group who will send the signal
- The receiver group who will receive the signal

Both groups will have to translate the signal they're sending/receiving into a code the light can use!

# Data Race – Light



# Data Race – Light

## Morse Code



a circle on your sheet means a quick flash



a rectangle means a longer flash that will take around two seconds

# Data Race – Light

A • —  
B — • • •  
C — • — •  
D — • •  
E •  
F • • — •  
G — — •  
H • • • •  
I • •  
J • — — — —  
K — • —  
L • — • •  
M — —  
N — •  
O — — —  
P • — — — •  
Q — — — • —  
R • — — •  
S • • •  
T — —

U • • —  
V • • • —  
W • — —  
X — • • —  
Y — • — —  
Z — — • •

1 • — — — —  
2 • • — — —  
3 • • • — —  
4 • • • • —  
5 • • • •  
6 — • • •  
7 — — — • •  
8 — — — — •  
9 — — — — • •  
0 — — — —

# Data Race – Light

## **WARM-UP**

Watch closely as I send a message and try to record it

Once you think you have the right message decode it!

# Data Race – Light

## WARM-UP

Watch closely as I send a message and try to record it

Once you think you have the right message decode it!



# Data Race – Light

Lets have a competition

Team 1 will send team 2 the first word they have

We will check if its right then swap the torch

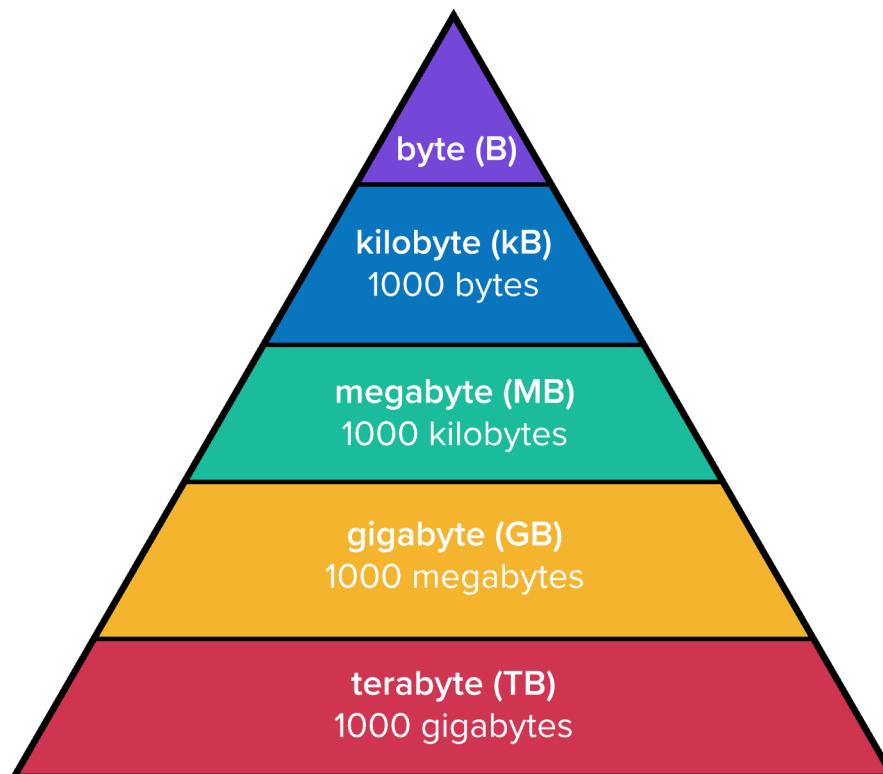
Once all words have been sent you win

If you try and cheat by saying or shouting your message across  
your team will be disqualified!

All your words are 5 letter words

# Bits and Bytes

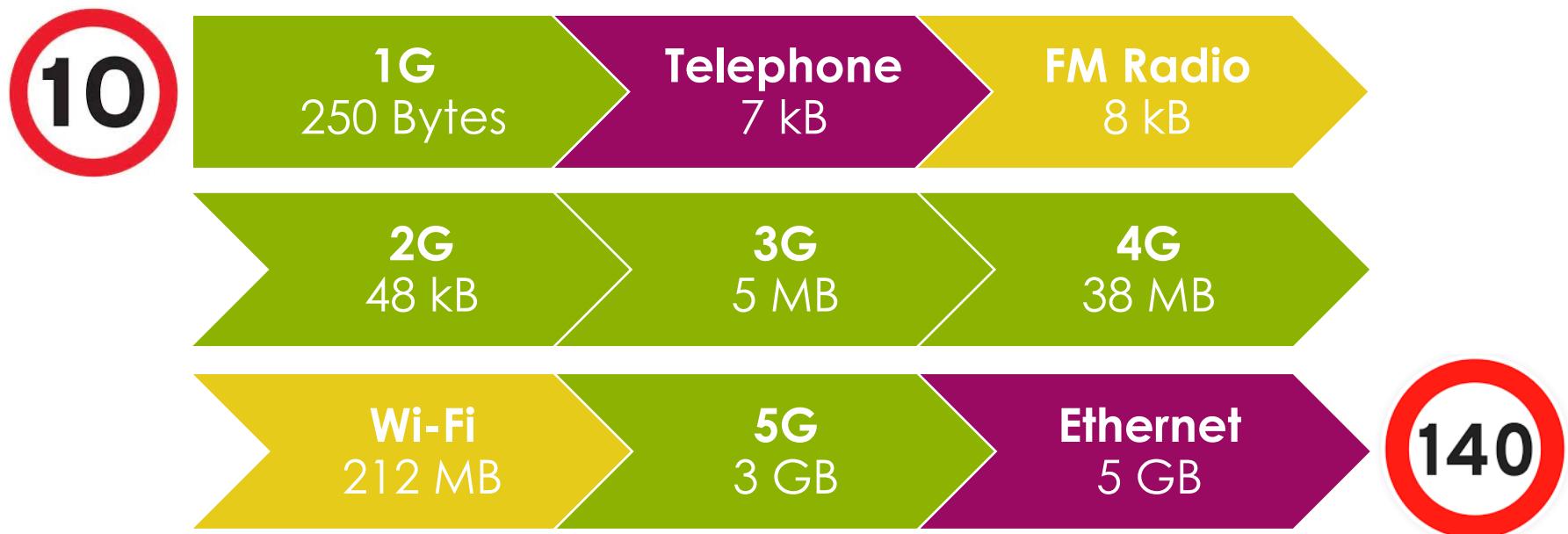
All these networks send data, but we need to know how to measure how much data they send.



# Connection Speed

Networks have different data speeds, this limits how much information can be sent between devices **per second**.

You can think of this like a speed limit on roads, the higher it is the quicker a car (information) can get from point A to B, and so more cars are able to travel down the road.



# Data Race – Sound

Now we're going to behave like a mobile network and deliver whole packages of information at a time.

Modern networks can communicate a lot more information at once, we can think of this like just saying the letters instead of flashing the morse code!

# Data Race – Sound

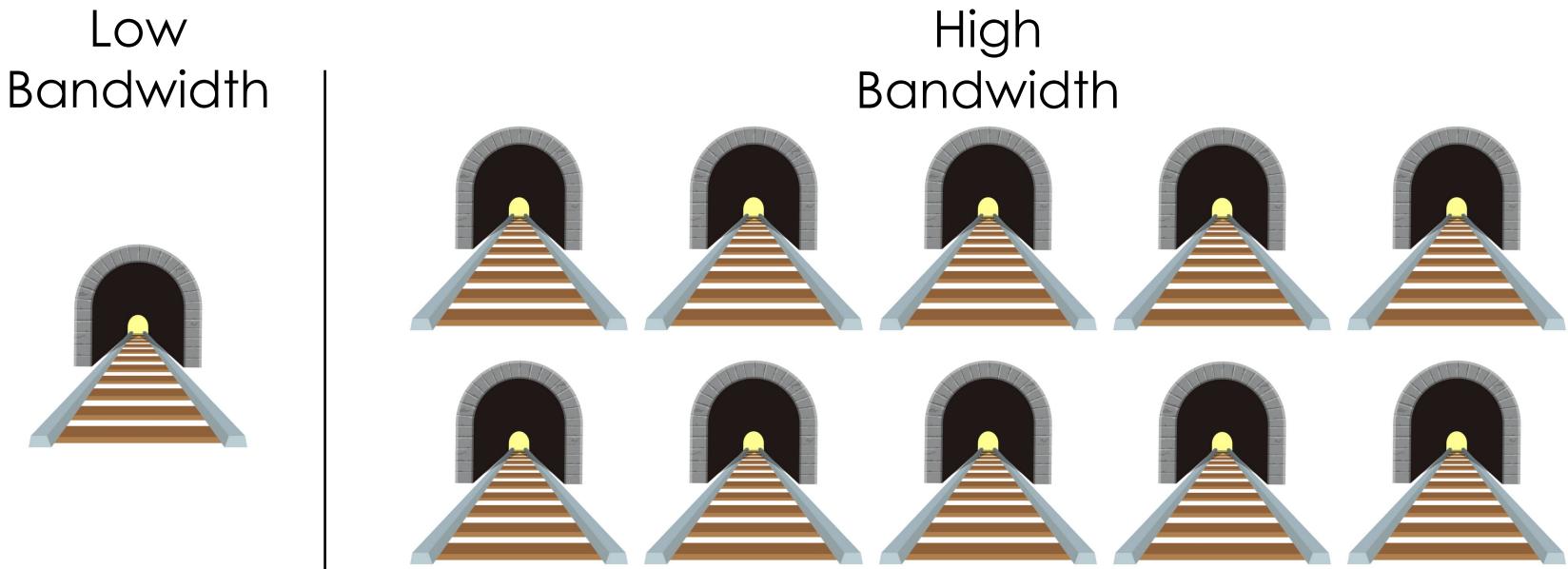
Now you're going to communicate the next set of codes by voice.

You will need to translate the code as a group and shout the letters to the receiver group one at a time.

# Bandwidth

A network is like a tunnel that connects two stations (devices).

Some networks can only connect to one device at a time (i.e. telephones), where others can connect to many devices at once (i.e. mobile phones).



# Data Race – Too Much Noise

As more bandwidth means that more devices can connect, we're now going to try everyone transmitting or receiving a message!

Each person in the class will be paired with one other person, and you will have to decode and transmit your code across the class with your voice!

# Data Race – Too Much Noise

Why was this a harder way of sending data to each other?

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Why was this a harder way of sending data to each other?

- It's hard to hear the correct signal

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Would this be possible to do with the entire school out on the yard?

# Data Race – Too Much Noise

Why was this a harder way of sending data to each other?

- It's hard to hear the correct signal

Would this be possible to do with the entire school out on the yard?

- No, there'd be far too many voices to hear properly!

# High Bandwidth = Short Distance

Just like shouting across a class, networks that can connect to lots of devices at once work over shorter distances!

That's why your phone will almost always connect to 3G, usually to 4G and sometimes to 5G.

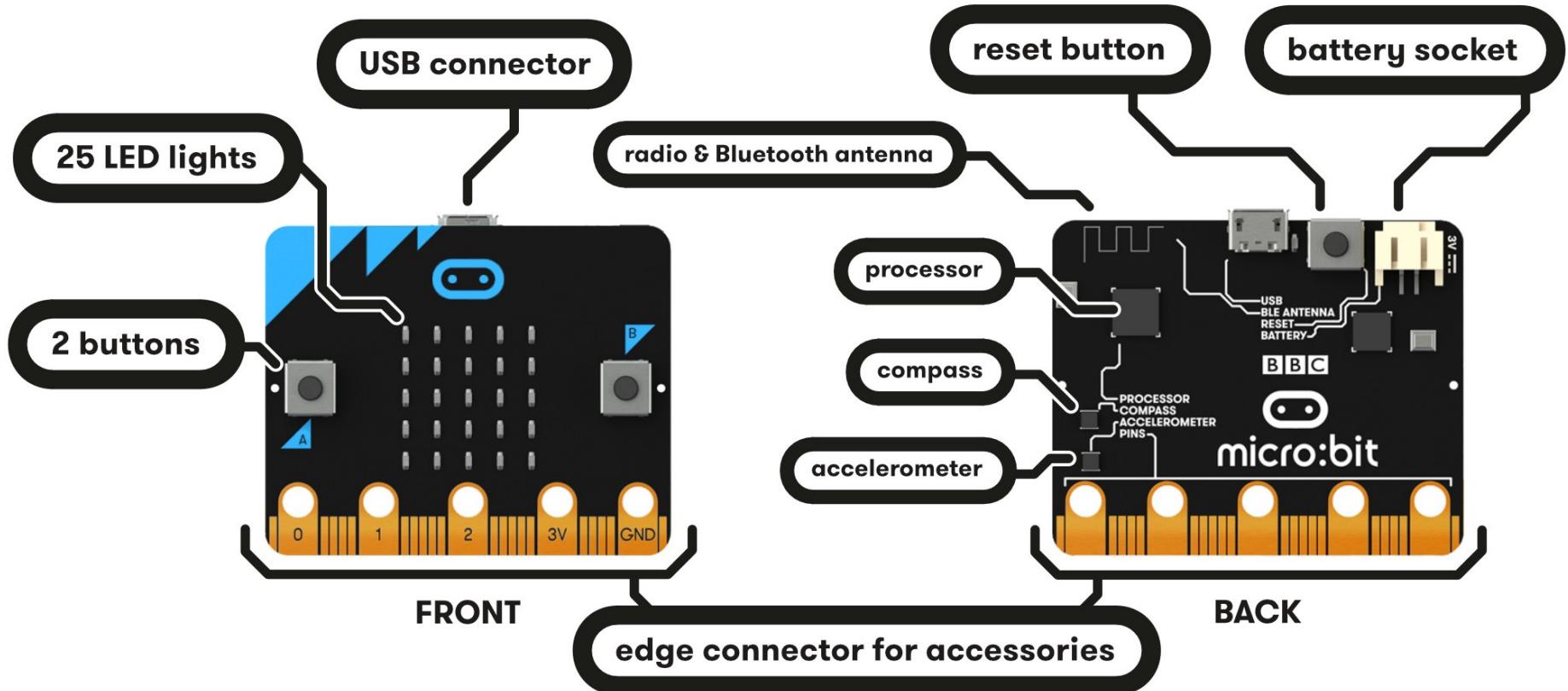
These newer networks are great for areas with lots of people (like a stadium) because then everyone can have signal.



# Mobile Network micro:bits



# What is a micro:bit?



# micro:bits

We're going to be using micro:bits to pick up mobile signals being broadcast in this room.

You will have to decode the messages received from the mobile signals using \_\_\_\_.

Will all the mobile signals transmit at the same rate?

# micro:bits

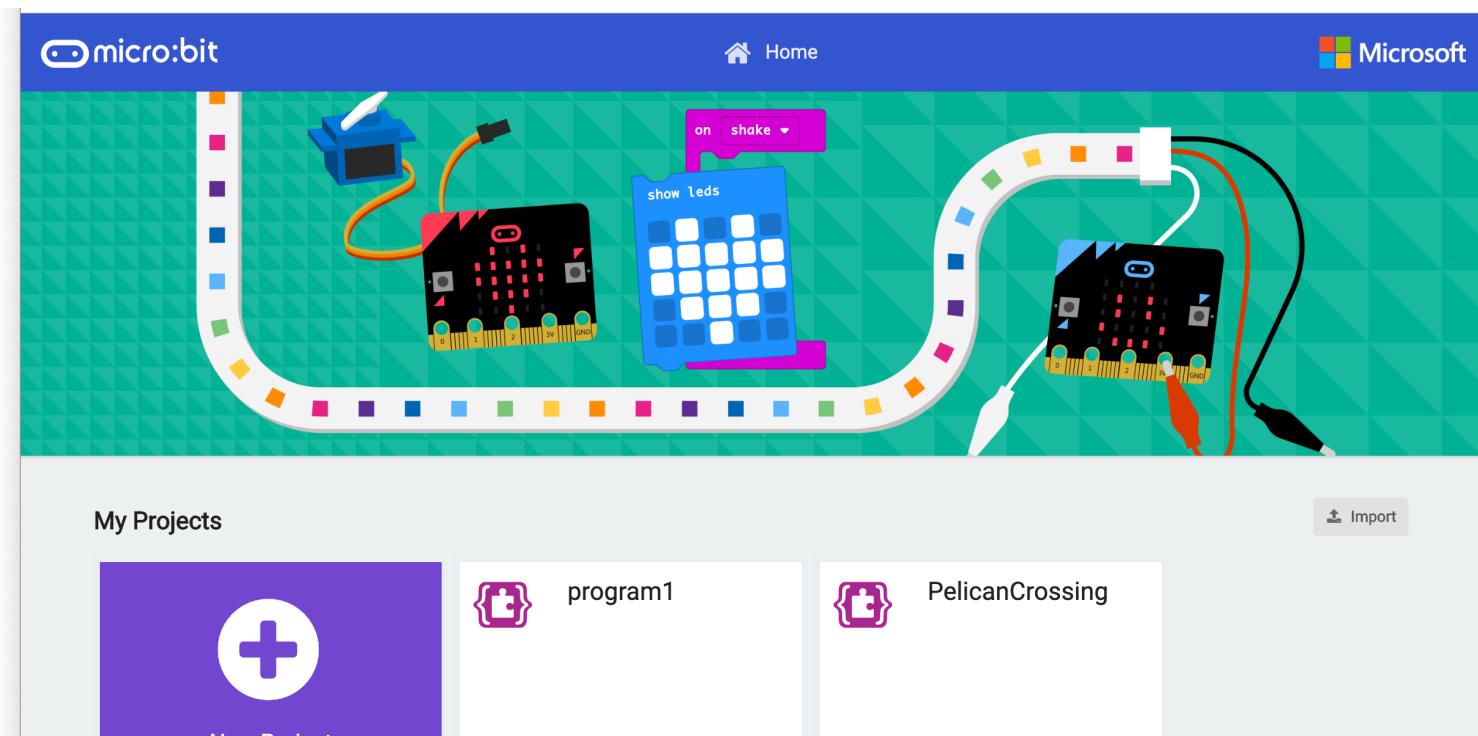
First we will have to program our micro:bits to enable them to pick up these signals being broadcast!

Log onto the laptops with the Password:

**technoweb**

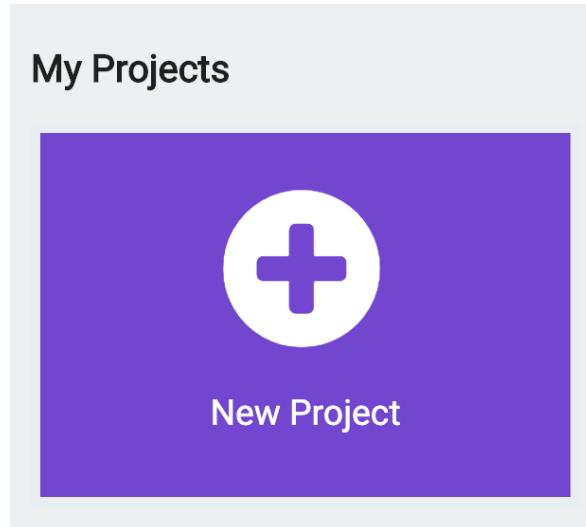
# Starting with MakeCode

Open the start menu, then search for and open the program MakeCode Microbit.

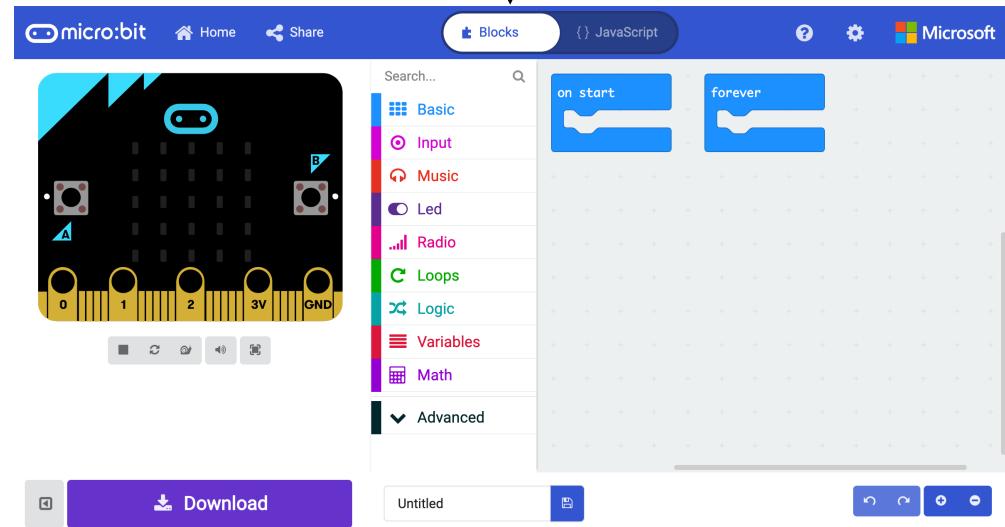


# Starting with Makecode

On the  
makecode.microbit.org  
website, click on New  
Project

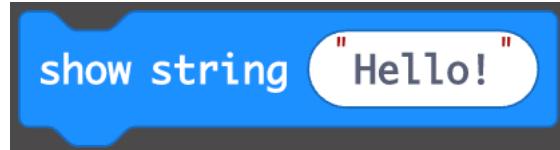
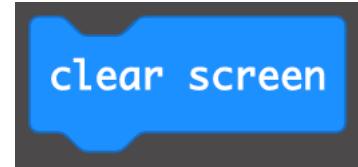
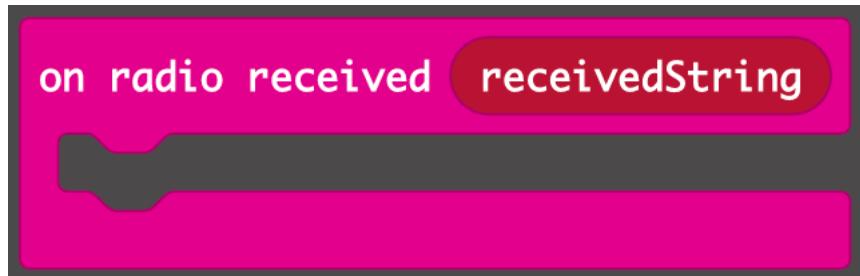


Once you enter the project page  
you will see a micro:bit simulator on  
the left, a code area on the right,  
and a save and download area on  
the bottom of the page.

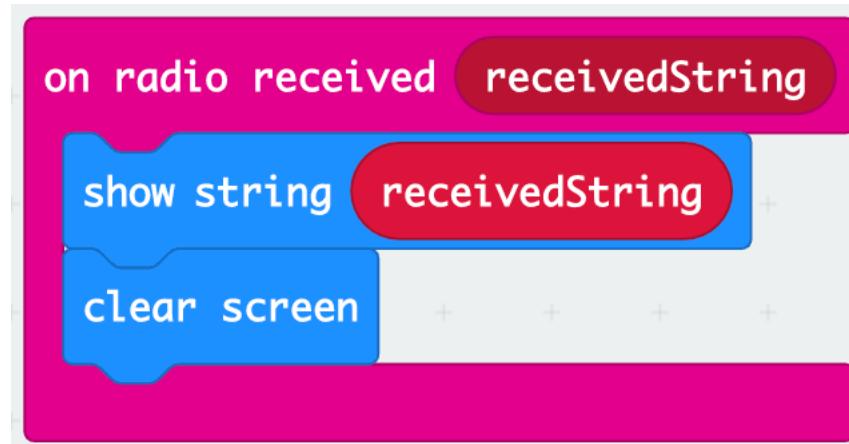


# Coding our micro:bits

Find these blocks on MakeCode micro:bit and drag them in.  
See if you can work out how they're assembled!



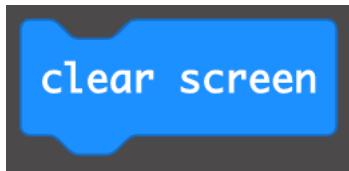
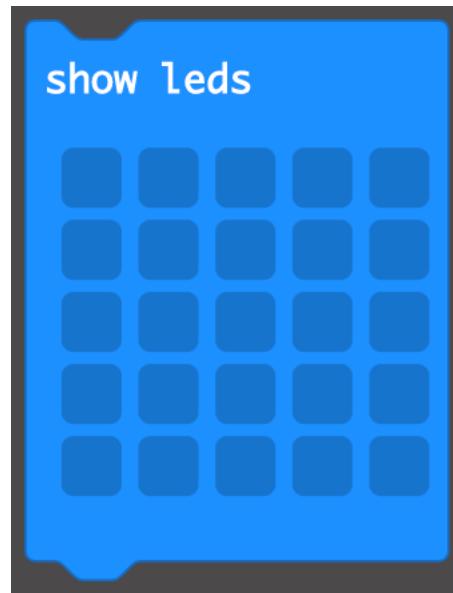
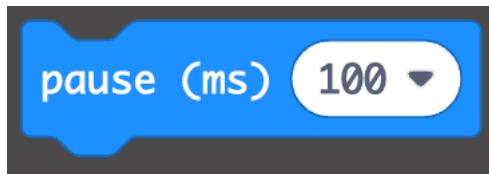
# Coding our micro:bits



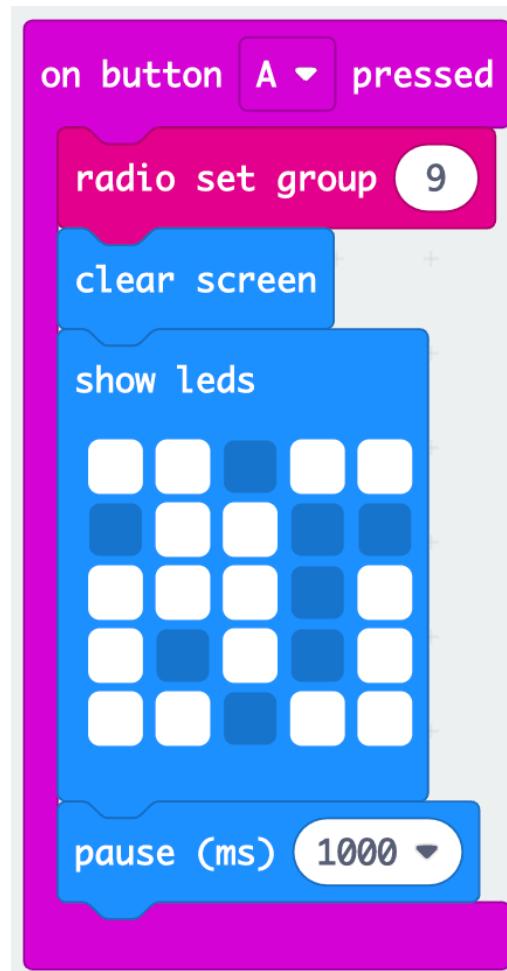
Note: the “receivedString” can be dragged out from above and dragged into the “show string block”!

# Coding our micro:bits

Find these blocks on MakeCode micro:bit and drag them in.  
See if you can work out how they're assembled!

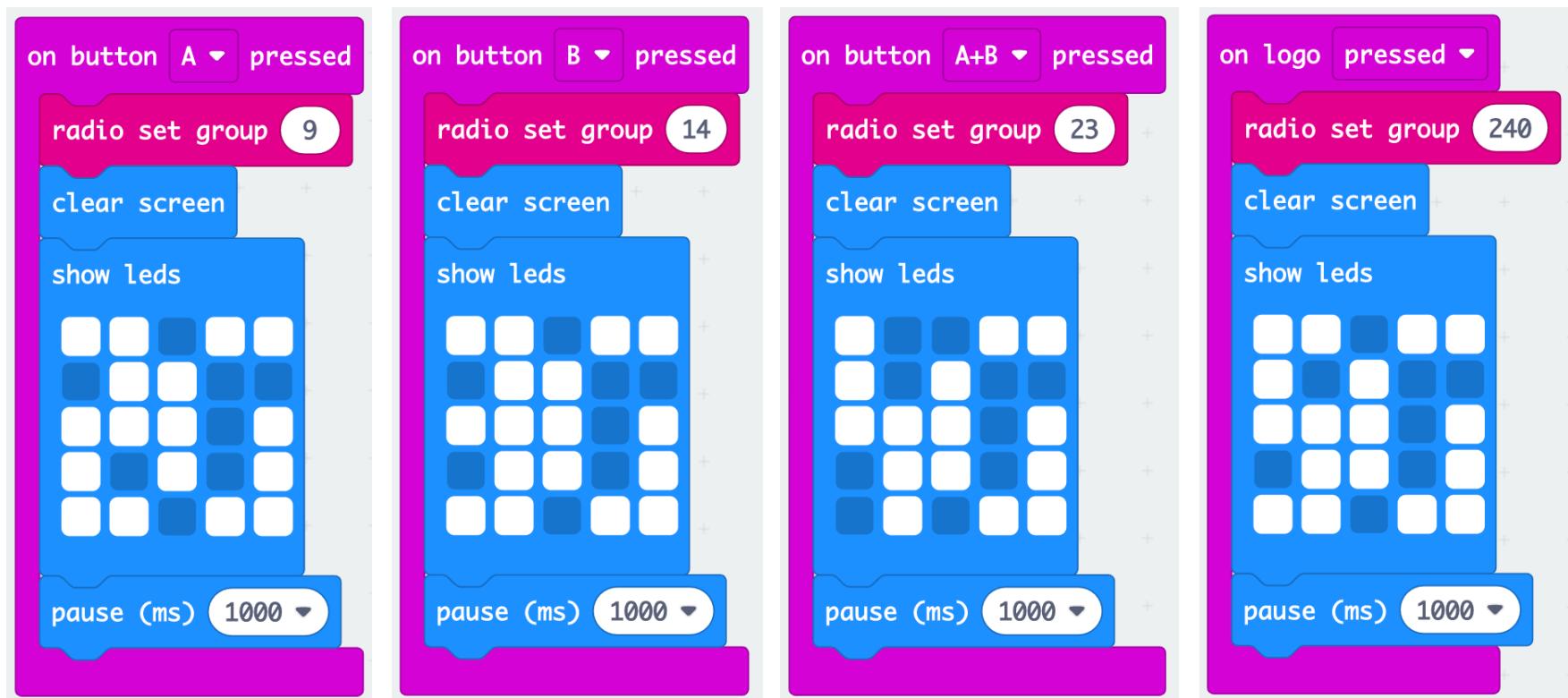


# Coding our micro:bits



# Coding our micro:bits

You will need to build three more of these, changing the “on button \_ pressed” block for each.



# Coding our micro:bits

You will need to set the "radio set group block to the following values:

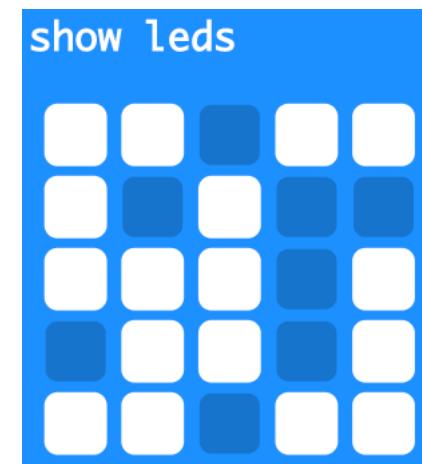
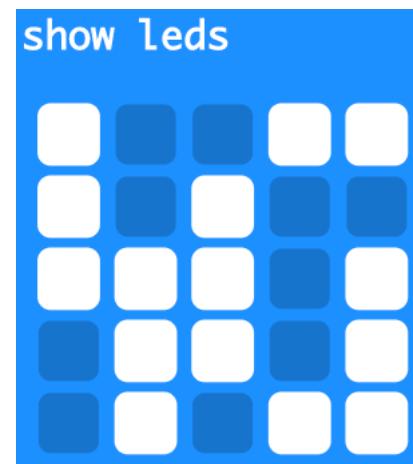
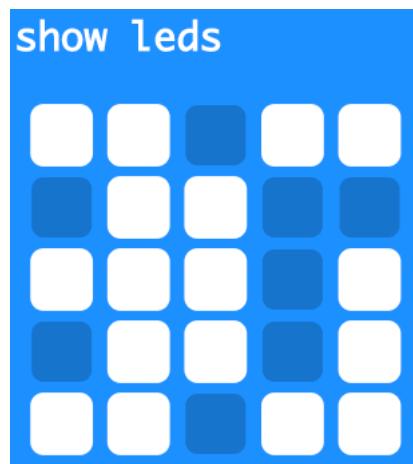
2G – 9

3G – 14

4G – 23

5G – 240

And the LEDs can be made to spell each network like this:



# Coding our micro:bits

Once you have finished building your program, connect your micro:bit to the computer using the USB cable.

The program can be downloaded onto the micro:bit by clicking the download button.

Wait for the download to finish before disconnecting the USB.

# Using our micro:bits

Now you have a programmed micro:bit tuned into the frequencies of each mobile network!

There are four micro:bit transmitters around the room broadcasting secret messages.

Tune your micro:bit to the right channel and copy down the message you receive from each transmission tower!

# Recap

Some benefits of 5G include :

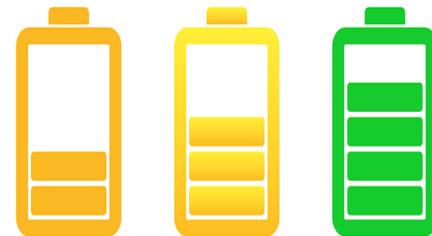
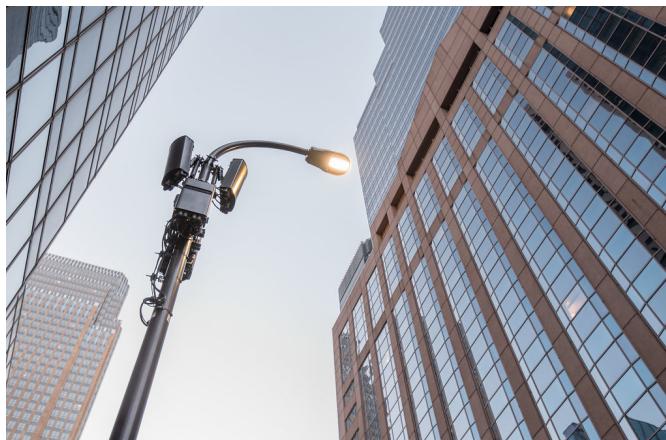
- Faster download speeds.
- Lower latency (You see your Fortnite enemies move sooner!)
- Greater number of connected devices.



# Recap

Disadvantages of 5G include :

- Only works with new phones.
- Buildings and trees get in the way of the signal.
- Using 5G drains your battery faster.
- Only travels a fraction of the distance



# 5G City

## Step 1:

Unlock your iPad

Open 5G town app

Select English

Select play

Input pin given to you

Scan area around cone

## Step 2:

Walk around the town

Complete a task

Pass iPad to next partner

If you need any help, just ask