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# The Infrastructure of the Internet

Today, there are 4.5 billion internet users around the world. There are more than 1.5 billion websites. In one second, people send nearly 3 million emails. They perform 81 thousand google searches. They also watch 83 thousand youtube videos.

**E-commerce** is business that takes place on the internet. It grew half a trillion dollars in 2019. It is now worth $3.5 trillion, which is double the GDP of Canada.

In order to power all of that connecting and sales the internet consumed around 10% of the world's electricity. It also produced 1 billion tonnes of greenhouse gasses.

### *ARPANET*

ARPANET was a giant computer network that became the internet. ARPANET stands for Advanced Research Projects Agency Network. It was developed by a branch of the US government in 1969.

The project grew over the years as more locations signed on. It got bigger than the US military wanted. Researchers from around the world helped develop the new system that meant that, in 1990, ARPANET was shut down. A deal was in place to create an open platform called the internet.

This article will look at the physical **infrastructure** that is responsible for the digital world.

## *How Does Your Computer Connect?*

Everything on the internet is stored on somebody's computer.

All of these computers are linked together. The internet is the rules and procedures they use to talk to each other.

When you're looking for a website, your computer first connects to your router. Your router sends a message to your internet service provider (ISP).

The network routers has a list of IP addresses it can send you to inside your regional network. If the IP address you are looking for is in its directory, it will send you there.

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If it doesn't have the IP address you're looking for, it will send you to higher levels in the network. You keep going up levels until a router contains the address you're looking for. You may need to go all the way up one branch of the network in order to go all the way down another. Especially if you're trying to access a website hosted on the other side of the world.

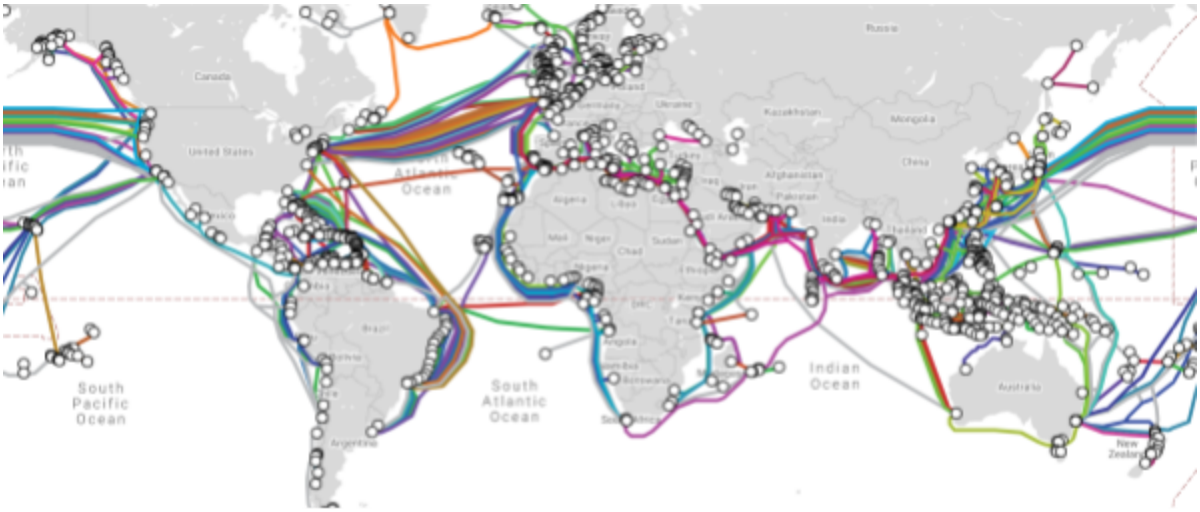
*Undersea Cables*

It takes more than computer science for a computer in North America to connect to a server in Australia, Europe, or China.

The infrastructure for the internet is built on the same path as phone lines. In many cases it was the same companies that laid the cable.The first underwater cable connected Ireland and North America. It was laid in 1854.

The work of laying undersea cables is done by special boats. They carefully plot routes to avoid anything that could damage the cable. Cables break anyway. Around 100 cables break every year because of ships dragging their anchor. There are enough cables to handle the load if a few are broken.

The map below shows the undersea cables that connect the different continents.




A map of undersea cables by https://www.submarinecablemap.com/#/

There are over 400 undersea cables spanning 1.2 million Km. These cables

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are what are used if you send an email from Asia to Australia. Or if someone in Europe watches a video hosted in North America. New cables can transmit more than 200 **Terabytes** per second. Without the undersea cables, computers on different continents could not talk to each other efficiently.

*Fiber Optic Cables*

Fiber optic cables have a higher **bandwidth** than old cables. That means they can transmit HD videos while very old cables could only send Morse code. Cables are constructed by drawing glass to be as thick as a human hair.

Light can be sent down this cable without any of it leaking out. Fiber optics can be used to carry messages and even power.

*Data Centers*

Most big technology companies and internet content creators (think Netflix, youtube, and Amazon) have data centers. Data centers are racks and racks of computers. Websites are stored on these servers. These centers provide the computing power that makes the internet work.

The data centers are the part of the internet that uses a large amount of power. The buildings that store data centers must be air conditioned and safe from fires.

A cell tower disguised as a palm tree

*Wireless internet*

A device is connected to all of this infrastructure even if it's not plugged into anything. Wireless internet and mobile networks are powered by radio waves. Mobile devices exchange messages with a cell tower. The cell tower is plugged into the internet.

Developing countries have put in more wireless internet than wired. In Kenya, 88% of the population accesses the web through their phones. In 2017 Kenya had faster mobile rates than the US.

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*Questions (Answer in complete sentences)*

*Comprehension*

1. Define the bolded words using a dictionary or another source.
2. What does a network router do if the IP address that you are looking for is not within its network?
3. How many and what length of undersea cable are there in the world?
4. What happens if one undersea cable breaks?
5. Why do data centers require so much electricity?
6. Does wireless internet require the undersea cables and data centers to work? Why?

*Space Based Internet*

The next step in internet infrastructure might be satellites that beam internet connectivity to hard to reach places. SpaceX and Blue Origin have plans to launch up to 12,000 satellites. Those satellites could connect people in hard to reach areas to the web.

*Inference*

7. What would happen if all of the undersea cables broke?
8. Why do you think that developing countries have developed more wireless technology?
9. Work from your own knowledge or research to draw a map or flowchart of the steps that were necessary to complete the last thing you did on the internet.