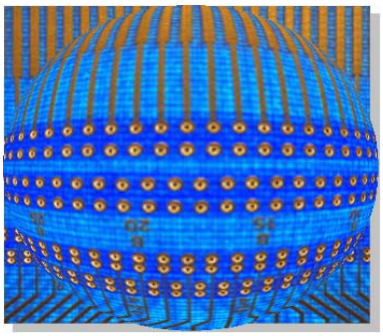
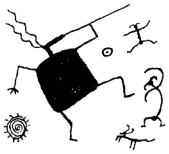


Communications

Worksheet 4

A worksheet produced by the Native Access to Engineering Programme

What is Communications?



Petroglyphs

The Merriam Webster Dictionary defines communication as:

1: an act or instance of transmitting

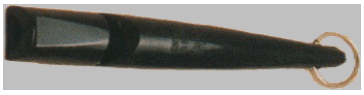
3: a process by which information is exchanged between individuals through common symbols, signs, or behaviours

4: a system (as of telephones) for communicating

5: b) the technology of the transmission of information (as by print or telecommunications)

Morse code

Sign language



Dog whistles

Semaphore

There are many different ways of communicating, some of them are pictured on this page. No matter how you communicate, at its root, all communications is about telling stories and sending messages.

How do we communicate?

All living things communicate in some form or another.

Whales and dolphins sing songs to identify each other and to navigate through the ocean.

Source: The Bob Talbot Collection
http://www.talbotcollection.com/default.htm

Bees dance to tell other bees where to find nectar.

Birds squawk to warn of danger.

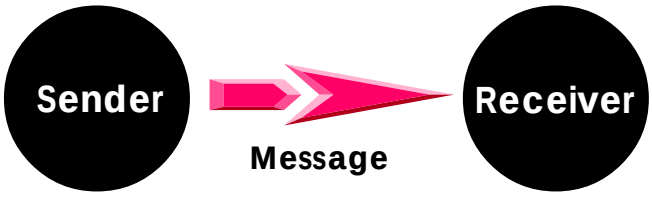
And human beings talk to each other.

What things are the same in each type of communication?

Messages, senders and receivers

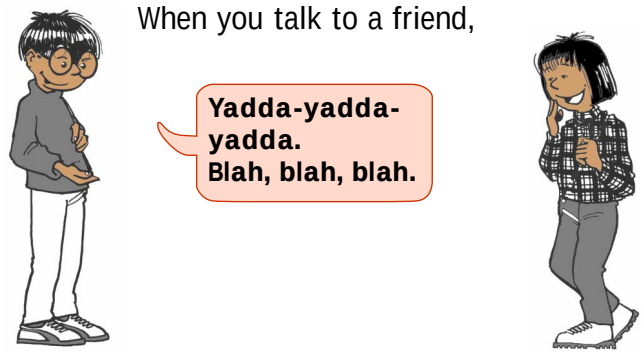
In all communication, whether it is between birds, bees, whales or humans, there are 3 basic elements. These are the sender the receiver and the message.

Engineers refer to the three elements of communications as the
Shannon-Weaver model of communication.



When you talk to a friend,

you are the sender,



she is the receiver,

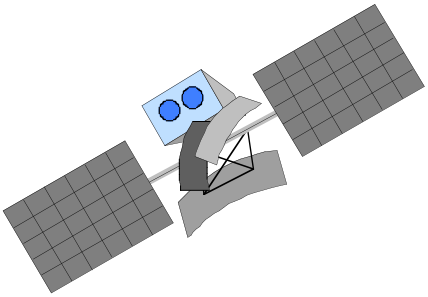
and whatever you are saying is the message.
When your friend talks the relationship is reversed.

This model is very useful because applies to any situation in which communication is taking place, no matter what or who the sender and receiver are, or what form the message takes.

How many different forms of message do you think there are?

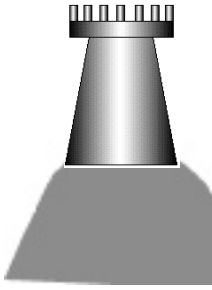
Telecommunications

"Tele" is a prefix which originates from Greek and means "far, far off" or "over a distance". So, telecommunications is communication over a distance.

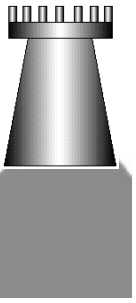


In engineering, the word is used to describe modern, long distance communication equipment like satellites, but ancient peoples had many effective ways of sending messages over long distances.

How do you think ancient peoples communicated over long distance?



In some areas networks of watch towers were built along coastlines, or on top of hills in order to provide early warning of invasions. A lookout who saw signs of hostile forces would do something to attract the attention of the lookout in a tower closer to the city or town they were protecting.



How do you think he did this?

He would light a fire on top of his tower, or strike a drum within the tower. This signal was then seen or heard by the other lookout who would then light his own fire or strike his own drum which would be seen by the next tower, and so on until the message of invasion got back to the city. With this quick and early warning, its warriors could march out or prepare to meet the invading force. It was an effective way to send a simple message over long distances very quickly.

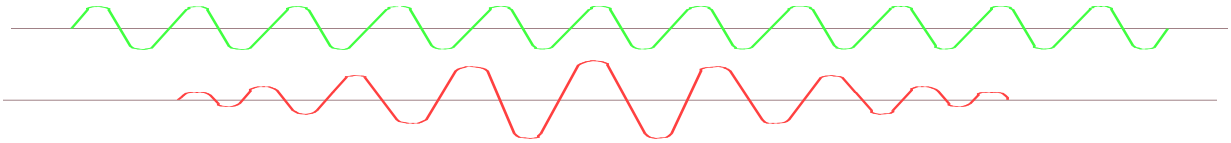
What do you think is the more effective way to send messages over long distance, fire or drums?

Aboriginal people in North America used both fire and drums to send messages over long distance.

They also had an effective communications network in the river systems they used for travel, hunting and trading.

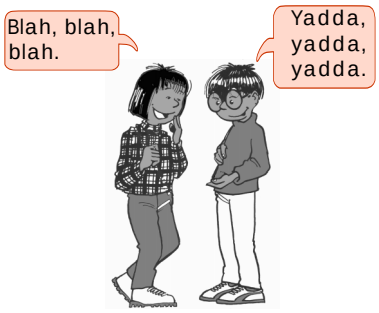
People travelling by river brought messages and stories from one community to another – not as quickly as fire or drums would, but in a lot more detail.

Modern telecommunications involves more complex sending and receiving technologies but has the same purpose as ancient tower or river networks did - to send messages over long distances; the only difference is that nowadays the messages are electronic.



What happens if something interferes with the transmission of a message?

Noise



Imagine you meet a friend on the street and the two of you are so happy to see each other you both start talking at the same time. Does she hear what you say? Do you hear her? Is a message exchanged?

In communications, anything which interferes with the transmission of a message is called noise.

Can you think of examples of noise?

Low-flying jets are noise, so are crying babies. In engineering terms, noise is anything which interferes with the electronic signal you are trying to see or hear. So, the hiss you sometimes hear on the radio is noise, so is the "snow" you sometimes see on the TV, and the screeching feedback from a microphone is definitely noise. Sometimes even silence can be noise. On satellite phones and some older phone networks there is a delay between when a person speaks at one end and when the message is heard by someone else at the other end; that delay is noise.

Did you know it is possible to see noise?

Do you know what causes the delay?

Electronic noise is caused by many things. For instance, atmospheric conditions like lightening, heat build-up in internal wiring or lack of power may interfere with a signal and cause noise.

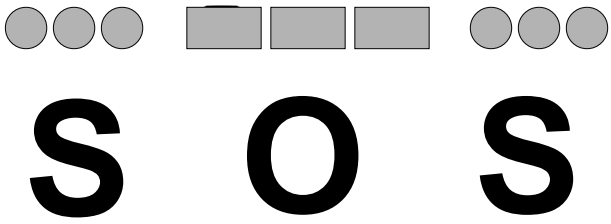
Communications Engineers

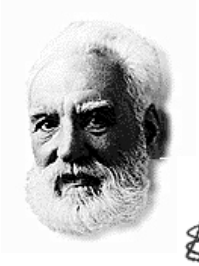
The job of a communications engineer is to make it easier for people and machines to talk to each other. They work in three main areas:

1. Designing and developing communications hardware like telephones, radios, televisions, satellites, wires, cables and satellites dishes.
2. Establishing means, like the Internet Protocol, for all these different machines to talk to each other.
3. Finding ways to keep noise levels as low as possible.

Networks

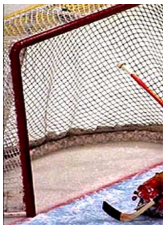
A network is a system where a whole bunch of individual components are hooked together, usually through some central area. As we've seen, Aboriginal people used river networks to travel and bring messages from place to place. The first electric networks were built alongside railway lines, and the messages they carried were the dots and dashes of morse code.

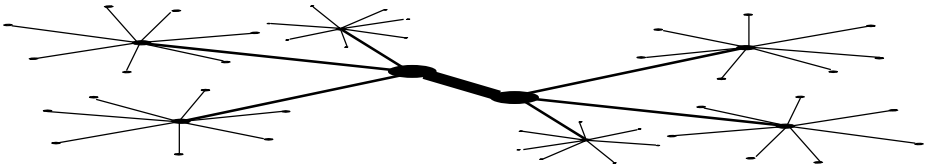




In 1874, the world's first telephone was invented by Alexander Graham Bell … in Canada! It's doubtful he would ever have imagined how important his invention would prove to be. It would eventually become part of one of the biggest networks on the planet.

If you were to draw a network it would look a bit like a spider's web or a hockey or fishing net, which is one of the reasons it got its name. Most local communications systems - telephone, computer, television – are linked together by cable or wire into networks. In small towns there may be only one central link for the network, in large cities there will be several central links which will be networked to other central links.





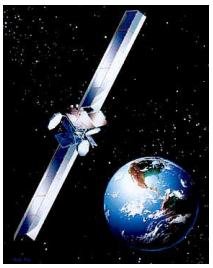
Canada is a huge country both north-south and east-west. It takes a lot of wire to link all the communications networks in the country together. And in some areas the country's geography makes it very difficult to lay wire.

What problems do you think Canada's geography presents to networking?

Telecommunications in Canada

In some areas of Canada it is very difficult to lay wire or cable because the ground is too rocky or the ecosystem too delicate. This physical reality means that for a large part of our history it was very difficult to get telecommunications equipment in remote regions of the country to talk to telecommunications equipment in other parts of the country.

About 30 years ago, Canadian scientists decided a way was needed to get signals across the vast expanse of the country. They realized that satellites would be the ideal way to do this, so they started to work on building a communications satellite for Canada. The result was Anik A1 which was launched in 1972. Since then, Canada has launched a whole network of Anik communication satellites. Canada was the first country to use a network of communication satellites. The newest Anik satellite, the F1, will be built at Hughes Space and Communications International and launched sometime in the year 2000.



Source: Hughes Spaces and Communications International
http://www.hughesspace.com

Sources

Online

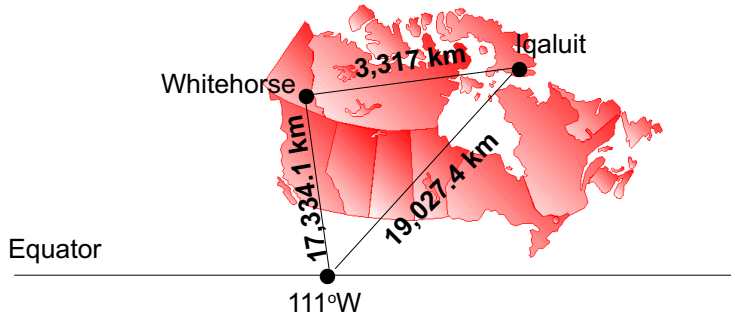
1. The Electric Club
   http://www.schoolnet.ca/math_sci/phys/electric-club/index.html
2. Hughes Space and Communications International
   http://www.hughespace.com
3. The National Museum of Science and Technology
   http://www.science-tech.nmstc.ca
4. The Whyfiles
   http://whyfiles.news.wisc.edu

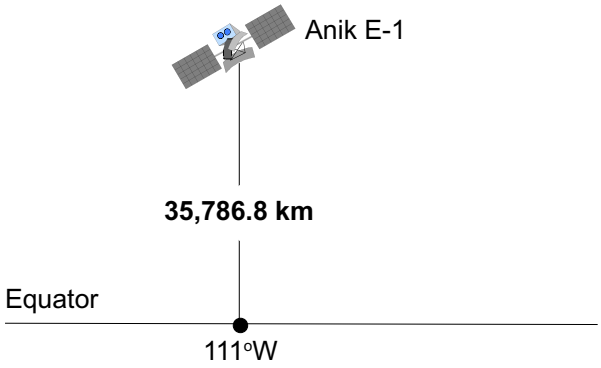
Math Problems

1. You are an engineer at Television Northern Canada (TVNC) in Iqaluit. You're making a presentation to visitors about TVNC's satellite capabilities. You tell them that you broadcast using the Anik E-1 satellite, which sits in orbit straight above the equator at 111° west longitude. At the end of your presentation a visitor asks a question.

   a) "How far does the broadcast signal travel when it goes from Iqaluit to Anik E-1 and back down to Whitehorse?"

   You know that the satellite is 35,786.8 km above the surface of the earth. You also know the distance from Iqaluit to 111° west at the equator, 19,027.4 km, and the distance from Whitehorse to 111° west at the equator, 17,334.1 km. What is the answer to the visitor's question?





   b) "Wow!" another guest says. "The actual distance from Iqaluit to Whitehorse is only 3317 km as the crow flies. That's a fairly small percentage of the distance the TV signal travels." You surprise the visitor by telling him exactly what percentage it is. What do you say?

2. As the head of network planning for the Cree Communications Society you are asked to plan how long it would take to hook up every person in the 9 communities to a new Cree-owned cellular telephone network. For a number of reasons, you decide to hook the communities up one at a time in the order shown in the table. Your engineering crew can only hookup 350 people per month. To make billing easier, when your crew starts in a new community it will be on the 1st of the month (even if they have less than 350 people to hook up the previous month). If the crews start work on January 1, 2000, can you draw a graph which will predict how the network will grow each month and how long it will take to hook up everyone? By the way, no hookups will be done during Goose Breaks in May and October.

Table 1: Cree population by community

Community	Population*
Nemaska	456
Eastmain	459
Oujé-Bougoumou	489
Whapmagoostui	571
Wemindji	956
Waswanipi	961
Waskaganish	1,423
Mitissini	2,307
Chisasibi	2,768

* Poplation figures from the Native Population Register (March 31, 1994)

Many thanks to Alfred Loon, Economic Development Office, Grand Council of the Cree, and Bruce Burlton, Telesat Canada, for providing data to make this edition's math problems possible.