~ Hello from Hawaii ~

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Calvin was in Miss Wormwood's geography class. She had been talking about islands and was saying, "Hawaii is the most remote island chain in the world, over 3,000 kilometers from the nearest landfall. The Hawaiian greeting is 'Aloha!', meaning 'Hello and welcome'. Hawaii consists of 8 major islands plus 124 minor islands, strung like a necklace across the Pacific for over 2,500 kilometers. The island names are: Hawaii, Maui, Lanai, Molokai, Oahu, Kauai,..."

Effortlessly Calvin found himself drifting off into another era. He was an adventurous sailor crossing the Pacific, and suddenly found himself shipwrecked in Hawaii. The natives took him to their chief who thundered, "At last, we have caught you. You pirate! Now you shall die." Calvin said, "Hey, wait! I am not a pirate.
See, I am alone. If I were a pirate I would have had many more men with me." Seeing the chief's hesitation, he continued, "What is your problem? Maybe I can help you."

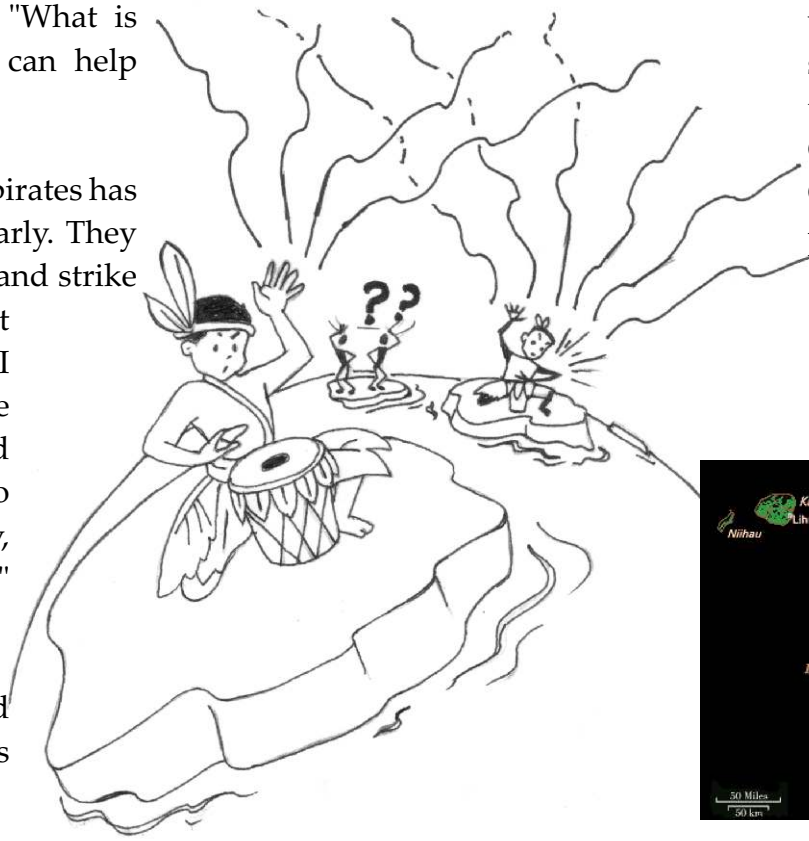
The chief said, "A gang of pirates has been plundering us regularly. They come out of the far ocean and strike one of the islands. The last time this happened, I talked to the chiefs of the other islands. We agreed that we would join forces to fight the pirates. Yesterday, the pirates struck Kauai." The chief paused.

"What happened?", asked Calvin. "The pirates boats are much faster than ours and the islands are also far apart. So by the time a messenger from Kauai could row across to Oahu and get reinforcements, the raid was over. We don't know where they will strike next."

"Why don't you use smoke signals?", said Calvin, "As soon as someone on Kauai spots the pirates approaching, they should light a big fire. The people from the other islands can see the smoke and come fast to Kauai."
"We tried that twice", said the chief, "Once the pirates also saw the smoke and kept away. The second time, they raided Maui while we all were assembling in Kauai.", he concluded dejectedly.

"How about using your drums to send messages?", queried Calvin, "The pirates will not be able to hear them from afar."
"We tried that too", said the chief. "The last time the drummers on both Maui and Oahu spotted the pirates. Since they were both sending out messages simultaneously, the people on Lanai and Molokai - being in-between both the drummers - could not understand anything. So nobody came to fight against the pirates."

Calvin thought for a while and said, "Aha! I know what your drummers should do. We can rout the pirates the next time."
Can you guess how Calvin solved the problem?
He called the drummers from all the islands and gave the following sequence of instructions:



1. Before you send a message using your drum, first listen for a short time.
2. If you hear someone else drumming during this time, wait till he finishes. Then send your message.
3. It may still happen that two drummers who are waiting, start sending simultaneously. So while sending, you should also be listening very carefully. If you hear another drum before you finish sending your message, then you should stop and try again later.

The next time, all the islands were ready and the pirates were defeated. The drummers started proclaiming Calvin's genius. Suddenly he was jerked back to reality and found that Miss Wormwood was rapping on his desk.
"Aloha!", said Calvin.

Interestingly, similar principles are followed in computer communications. In the late 1960s, Professor Norman Abramson and his colleagues at the University of Hawaii, wanted to find a way to interconnect computers on the other islands with the University's€™s main computer on Oahu. They devised a communication mechanism and called it the ALOHA protocol. ALOHA is a two-step protocol with a very simple idea. The first step is: "If you have a message to send, just send it". Now, the computers talk to one another through a single 'medium' that all of them are connected to. This medium may be a wire or wireless. It is also called the 'channel', or 'carrier' of communication. Sometimes two computers may try to send a message at the same time. This jumbles the messages and makes them meaningless. This is called interference or a 'collision'.

So the second step of the protocol is: "If your message collides with another transmission, try resending later".
The success of the ALOHA protocol is based on the fact that when there are only a few computers, if each computer sends only small messages, the chances of a collision are small.

As the number of computers increase, the chances of a collision also increases. So ALOHA was later extended by modifying the first step into: "If you have a message to send, first check if someone else is already transmitting. If so, wait till the other transmission is over. Then send your message." This modified protocol is called CSMA.
You may have come across the term LAN. This stands for Local Area Network. A LAN is a network connecting computers in a local area, like an office, college or small group of buildings. The most common way of creating a LAN is to connect the computers using wires called Ethernet. The LAN may also be created by enabling the computers to transmit and receive in a wireless manner, which is called WiFi.
Both Ethernet and WiFi networks use variations of CSMA to ensure that the computers can communicate efficiently.

CSMA stands for Carrier Sense Multiple Access. "Carrier Sense" describes the fact that a transmitter listens for a 'carrier' wave before trying to send. The presence of the carrier wave indicates that there is a signal from another transmitter.
"Multiple Access" describes a mechanism that enables multiple nodes to send and receive using a single communication medium. Transmissions by one node are generally received by all other nodes using the medium. Simultaneous transmission by multiple nodes results in collisions. The multiple transmissions interfere with each other so that all

are garbled and receivers are unable to distinguish the overlapping received signals from each other. It is impossible to entirely prevent collisions in CSMA networks, but there are way to address them.

While CSMA may sound simple, there a lot of intricacies. For example, How does a sending computer know that
its message has collided with another? When it tries to "re-send later", how much time should it wait?
What happens if two colliding computers wait for exactly the same amount of time before "re-sending"?

LAN: Local Area Network. A term for interconnected computers in a local area, such as office. CSMA: Carrier Sense Multiple Access. A mechanism to ensure that computers on a LAN can communicate efficiently.
Ethernet: The most common technology for creating LANs by using wires to interconnect the computers.
WiFi: A technology for creating LANs by using wireless communication between the computers.

Some interesting related websites are:
http://www.ucomics.com/calvinandhobbes/
http://en.wikipedia.org/wiki/Calvin_and_Hobbes
http://en.wikipedia.org/wiki/Hawaii
http://en.wikipedia.org/wiki/ALOHAnet
http://www.invocom.et.put.poznan.pl/~invocom/materials.php

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