What is the Information Superhighway?


[Sidebar.] Dave Moursund is Editor-in-Chief of The Computing Teacher and Executive Officer of ISTE. He has been teaching, writing, and speaking in the field of computer technology in education since 1963. In this new column, he offers answers to questions from readers.

Q. What is the Information Superhighway? Is it just hype, or should schools be doing something about it?

The Information Superhighway is a combination of "hype" and a profound component of the Information Age.

It is appropriate to think of any type of a computer network as an information highway. Timeshared computing makes use of computer terminals that are located some distance from the computer. Timeshared computing was already well established when the programming language BASIC was being developed about 30 years ago.

The storage capacity and speed of computers has grown immensely over the past few decades. This has made it desirable to increase the speed of the networks connecting computers. Thus, year after year, people have been working to increase the capabilities of the information highways. Breakthroughs such as communication satellites and fiber optics have made major contributions.

Many people now have a "gig" drive on their personal computers. A gigabyte of storage is 1,024 megabytes of storage. At one time people thought of a gigabyte as an overwhelming amount of data. If you are talking strictly about text, then a gigabyte is approximately 1,000 full length novels.

However, suppose that you are talking about graphics. How much storage does one high resolution color picture take? Suppose that the picture is eight inches by 10 inches, that it is stored at a resolution of 1,200 dots per inch, and that it is represented using 256 colors. If no data compression is used, this one picture requires about 112 million bytes of storage. A gigabyte of storage is filled up by about 10 of these pictures.

Suppose that you wanted to send a gigabyte of data between two computers by use of a telephone line and modem.

In the early days of computer networking, the information highway often had a speed limit of 300 baud (30 characters per second). To transport a gigabyte of data at this speed would take about 10,000 hours, or well over a year.

We now have much faster modems, and the telephone lines that are in place can handle much higher data rates. Many people make use of a modem that operates at a speed of about 1,400 bytes per second. At this speed, it takes only about 200 hours to transfer a gigabyte of data. Clearly, that is still far to long a time. The postal service or a courier service can do it faster and cheaper.
What is needed, of course, is a data transfer rate that is consistent with the storage capacity of modem computers. If you are working with color pictures where a single document is more than a tenth of a gigabyte, you would like to be able to send that document to another computer in a "reasonable" amount of time, such as a second or a few seconds.

If an information highway can handle a data rate of a few thousand bytes per second, what do you call a system that can handle 10 million or 100 million bytes per second? The term "Information Superhighway" comes from such thinking.

Of course it is hype to suggest that a sudden breakthrough has occurred or that such a breakthrough is needed. Rapid progress has been occurring for years and such progress will continue to occur for years to come. However, the term Information Superhighway helps to focus attention on the cumulative effect of this rapid change.

An Information Superhighway changes the nature of how teams of people work together to solve problems. Consider a team of people who are working together on a computer-based project, but the team members are scattered throughout the country. Their computers are connected by an Information Superhighway. This means that as they work together on a project—perhaps one involving high resolution color graphical data—the time delays caused by transmission of shared data are minimal. For example, one of the sites may have sophisticated scientific instrumentation that is making measurements or collecting photographic data that needs to be analyzed by the other sites. The results of their analysis are fed back to the data-gathering site (in "real time") to guide further data gathering.

Now, what does all of this mean for education? The underlying ideas of the Information Superhighway are of teams of people working together to solve problems and accomplish tasks that involve huge amounts of data. The data may be stored at a variety of sites. The Information Superhighway allows the team members to be located throughout the country. A person may be a member of several different teams. Teams are created and disbanded as the need arises.

Education needs to prepare students for problem working in such environments. Thus, students need to learn to work with problems that are represented using large amounts of data. They need to learn to work in teams, where the members of the team are separated by a distance.

With a little ingenuity, this type of situation can be created using a low-speed local area network within a school building or even within a classroom. For example, one member of the team may be gathering data in a science lab while a different team member is using a scanner to generate graphical data. Other members of the team may be in other parts of the building, retrieving information from databases, analyzing the data, and directing the efforts of the student working in the lab and the student using the scanner. Communication among team members is done strictly via computer. The goal is for the team to accomplish a prescribed task and produce appropriate reports on the results.

[Send your questions for this column to The Computing Teacher, ISTE, 1787 Agate Street, Eugene, OR 97403-1923; fax 503/346-5890; E-mail isfe@oregon.uoregon.edu. You may E-mail Dr. Moursund directly at moursund@oregon.uoregon.edu.]