

Going the Last Mile

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Are you spending a lot of time waiting for web pages to download? It seems that in every newspaper and magazine there is at least one news item and many advertisements on the topic of broadband. Government broadband policy is also the topic of many radio-spots. To the consumer, broadband is ISDN, DSL, cable modem, and satellite links. Do we need these technologies, or is the industry just trying to sell us something? Let us first consider who may benefit from broadband and why. Then we will discuss the economic and technical reasons that are impeding the spread of broadband communications and introduce the solutions that are currently possible and their viability.

THIS COMPUTER IS SLOW

Most of us connect our computer to the web through a device called a modem. Sometimes this is a separate box that is connected by a cable between the computer and the telephone line. More often, the modem is built into the computer itself and requires only a usual telephone cord between the telephone plug on the computer and the telephone jack on the wall. Most modems today are known as "56K modems." A 56K Modem has a top speed of 56,000 bits per second. This means that it is capable of transmitting 5,600 characters of text each second. The speed is dependent on the quality of the telephone circuit and typically is closer to 4,800 characters per second. That's still approximately 2 screens of text every second, clearly faster than anyone can read. Web pages, however, contain more than text. A web page usually also contains pictures. It is the picture that causes the problem of slow web download.

PICTURES CAUSE THE PROBLEM

The proverb states that a picture is worth a thousand words. In the world of digital computers, it may be said that a picture may take longer to download than a thousand words. A digital picture is made up of dots or pixels. The screen of most computers today is capable of displaying 1,024 dots across the screen, that is, a horizontal line from edge to edge is made up of 1,024 individual dots. These screens are capable of displaying 768 of these horizontal lines from top to bottom. Therefore, a picture that fills the screen is made up of 1,024 x 768 or 786,432 dots. If each of these dots is one of 256 colors (hundreds of colors for Mac users), then the picture is the equivalent of 786,432 characters, enough to fill approximately 280 screens. Using a 56K modem, it will take at least 140 seconds to download. If each dot in the picture was one of 16 million colors (True Color for PC users, millions of colors for Mac users), then the picture will take 3 times longer to download.

... pictures cause ... slow web download.

Recognizing this as a storage and transmission problem, the computer industry developed methods to compress images so that they can be stored more compactly and downloaded in less

time. A very common compression scheme is the JPEG (pronounced “jay-peg”) scheme. These pictures can be identified as they are downloaded by the “.jpg” at the end of their filenames. Images may be compressed as much as 50 times so that our 786,432-dot, 256-color picture can be transmitted in the time it would take to download a 15,730-dot picture, approximately 3 seconds. This sounds good, but there is a cost. The greater the compression, the less the detail. That is why diagnostic quality medical images are almost never compressed. In addition, the greater the compression, the longer it takes for the receiving computer to decompress it. Even though the decompression time is dependent of the speed of the receiving computer, it typically takes much longer to decompress a picture that has been compressed 50 times than it takes to download it. That is why most web pictures are compressed only about 10 times, a good compromise between download time and decompression time. The download time for our full screen, 786,432-dot, 256-color picture would typically be approximately 14 seconds.

DO YOU CARE?

The most important question then is: are you spending a lot of time waiting for web pages to download? If you are looking at pictures, the answer is probably “yes.” If you are not browsing a lot of pictures, or the download time doesn’t bother you, you don’t have a problem. Unless you are just curious, or your children have been asking you to get them a more expensive kind of phone line or cable connection, you have no need to read further.

If you are bothered by download time, there are solutions. Despite the advertising claims, none is perfect. Each comes at a price and each may not be available at your location. In fact, you may not have a choice, because none of the solutions may be available at your location.

THE LAST MILE

The problem that needs to be overcome is the traditional “last mile” problem. It makes economic sense to build new infrastructure between central facilities in order to handle high-speed data. However, the installation of new cables, either copper and fiber optic, between the central facility and your home or office location, is not economically feasible. The idea is to use the existing infrastructure, telephone, cable television, or satellite to carry high-speed data. This infrastructure was never designed to carry such data, so special coding schemes and innovative transmission methods have been developed to allow the existing “last mile” infrastructure to do what it was never designed to do.

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You already know the rest of the story. Broadband last mile solutions include ISDN, DSL, aDSL, sDSL, cable modem, and satellite link. Because these solutions are currently on the leading edge of communications technology and are just being introduced in many areas, their reliability is not perfect. Subscribers to these services are considered as first adopters, and there

is a lot of shakeout among the industry vendors. That is not to say that if you have the need, you shouldn't join in the experiment. Just join in with your eyes open.

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