

## Bandwidth and Web-Based Multimedia

Technically, Shockwave has no file size limitation. The dramatic compression it provides make it tempting to create larger Web-based applications. But given the tremendous variation in connection methods and speeds available to users, the multimedia developer is wise to give careful consideration to *bandwidth*. Bandwidth is the "width" or capacity of the "pipe," or communications link, through which the user connects to the source material. If you are *sure* that your users will be connecting with a high-speed link, you can allow your Shockwave file to grow larger; but if the link could be by modem, it's a good idea to keep the file size down. One strategy is to create multiple versions of your content, then determine the user's bandwidth (possible through various methods), and then serve an appropriate version of the content for each case.

Note that communication speeds are conventionally defined in *bits* per second (or kilobits (Kb), megabits (Mb), or gigabits (Gb)), while computer data is generally measured in *bytes* (or kilobytes (KB), megabytes (MB), or gigabytes (GB)). Eight bits equal one byte. So, a 28,800 bits-per-second (28.8Kbps) modem can transfer 28,800 divided by 8, or 3,600 bytes (3.6 KB) per second. (Your Shockwave files are generally measured in bytes.)

Today, the majority of Internet users are still connecting at a relatively slow 28.8Kbps. At best, a 28.8Kbps modem can download data at about 3.6K bytes per second. Thus, a 90K file will take about 30 seconds to download under ideal conditions. Even with a 56Kbps modem, the top of the line for dialup, the limit is about 7K bytes per second. 56Kbps is the maximum that analog telephone lines can handle via modem. To go faster, you need a digital connection. While cable modems have been gaining in popularity recently, it is unlikely that they will reach even a substantial percentage of the Web audience anytime in the near future, let alone a majority. The biggest news recently is DSL (Digital Subscriber Line), which provides a fast digital connection over a dedicated POTS (Plain Old Telephone Service – or copper wire) line. It will likely still be a decade before true broadband (Cable or T1 speeds) are used by a majority of the general public.

The table below illustrates the bandwidth for various types of connections:

<b>Delivery Medium</b>	<b>Maximum Transfer Rate bits per sec</b>	<b>Bytes per sec</b>
14.4 Kbps modem	14.4 Kbps	1.8 KB
<b>28.8 Kbps modem</b>	<b>28.8 Kbps</b>	<b>3.6 KB</b>
<b>56 Kbps modem</b>	<b>56 Kbps</b>	<b>7 KB</b>
DS-0 / Single ISDN B-Channel	64 Kbps	8 KB
ISDN BRI (2 B-Channels)	128 Kbps	16 KB
ISDN PRI (23 B-Channels)	1.472 Mbps	184 KB
<b>DSL</b>	<b>128 Kbps - 1.544 Mbps</b>	<b>16 - 193 KB</b>
T1	1.544 Mbps	193 KB
Ethernet	10 Mbps	1.25 MB
Cable modem	56Kbps- 30Mbps	7KB - 3.75MB
T3	44.736 Mbps	5.592 MB
Fast Ethernet ("gigabit Ethernet")	100 Mbps	12.5 MB
ATM / B-ISDN / SONET OC-3	155.520 Mbps	19.44 MB
Optical OC-12 (only Pac Bell has this)	622Mbps	77.75 MB