# Analog versus Digital: Making the Conversion

Data is processed in one of two ways: analog or digital. People generally process analog data—that is, continuous wave patterns. The sight and sound of a traveling subway car transmits to your eyes and ears as light and sound waves, or smooth up-and-down patterns. A computer, by contrast, is digital, which means computers process data in two discrete states: positive (on or 1) and nonpositive (off or 0) as shown below.

Digital signal

Analog signal
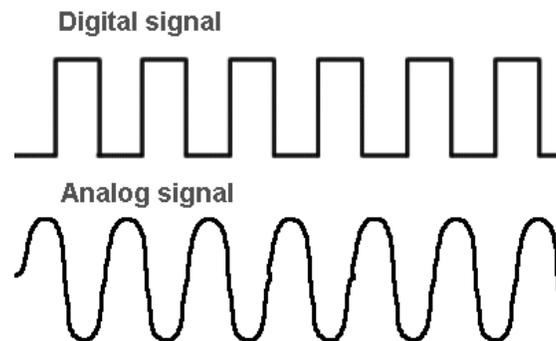
If sound and light waves are analog and a computer is digital, how does a computer record audio clips, play music, or show a movie? How can a digital computer use an analog telephone line to dial up to access the Internet?

The key lies in analog-to-digital and digital-to-analog conversions. The computer's sound card, for example, performs these conversions to record a digital audio clip of you analog voice. The sound card connects to the microphone, which is an analog input source. The diaphragm in the microphone converts the analog sound waves into an electrical signal. This signal flows to the sound card's analog-to-digital-converter (ADC), which converts the signal into digital data.   The digital data flows to the digital signal processor (DSP), compressing the data to save space. Finally, the DSO sends the compressed data to the processor, which stores the data in an audio file format.

To play a recorded sound, the computer reverses the process. The processor retrieves and sends the digital data to the DSP to be decompressed. The DSP sends the decompressed, digital data to the sound card's digital-to-analog converter (DAC), which converts the digital data back to an analog voltage for output via a speaker or headset.

Similarly, a video card allows you to record a video or play a movie on a DVD. The video card converts the analog signals into digital data and translates them back into analog signals and sends them to the monitor and speakers, where they display as your movie.

The modem in a computer also links the analog and digital worlds. When using a dial-up modem, the computer does not transmit data directly across analog telephone lines. Instead, the modem converts the computer's digital signals to analog signals (called modulation) to be sent over telephone lines. When the analog signal reaches its destination, another modem recreates the original digital signal (demodulation). The allows the receiving computer to process the data. The next time you dial up suing a modem, pick up the telephone. The loud, screeching noise you hear is the sound of digital data after being converted to analog sound waves.