PART IV
DENSE WAVELENGTH DIVISION MULTIPLEXING

Transporting SONET OC-192 (or SDH STM-64) signals at 10 Gb/s over single-mode fiber has become a technology of the past. Transporting OC-768 at 40 Gb/s over single-mode fiber for 100 km is an advanced technology that is becoming readily available. At 40 Gb/s, half-a-million simultaneous telephone conversations can be transmitted. Transporting above 40 Gb/s is the next challenge. Although such rates may seem more than adequate, combined voice and data traffic (video, Internet, etc.) may require yet more bandwidth in a single fiber. Thus, some reasonable questions are: What is the upper bandwidth limit in a fiber? At what point will optoelectronic (transmitter, receiver) devices reach their limit? Does this mean that optical fiber is approaching a maximum bandwidth capacity?

Advances in laser and optoelectronic device technology have made it possible to transmit more than one wavelength in the same fiber. This practice is known as *wavelength division multiplexing* (WDM). Adding wavelengths in the same fiber effectively increases the bandwidth capacity of a fiber and thus negates the immediate need to install additional fibers or increase the data bit rate to extremely high levels. That is, WDM enables transporting the equivalent bandwidth of several OC-192 (or OC-768) signals by carrying each signal on a different wavelength in the same fiber. In the full low-loss range of a single mode fiber (1200–1600 nm), some 1000 wavelength channels separated by 50 GHz may be used. At 40 Gb/s per wavelength, a total aggregate bandwidth of 40 Tb/s per fiber may be achieved. Assuming 50% utilization of a 432-fiber cable, the total aggregate bandwidth is an astonishing 8000 Tb/s.