SONET (Synchronous Optical Network) creates a standard to provide a transport infrastructure for worldwide telecommunication. The SONET format allows different types of signals to be transmitted in one line. Communication between various localized networks is costly because of the differences in digital signal hierarchies, encoding techniques, and multiplexing strategies. To solve this problem, SONET standardize the rates & formats. As its name suggests, the advances inspired the development of SONET in the accuracy of clocks and in optical transmission that has a high bandwidth capacity.

The Synchronous Transport Signal - Level 1 (STS-1) frame, which is referred as in the electrical domain, is the basic building block of SONET. In the optical domain, it is referred as the Optical Carrier signal - Level 1 (OC-1). Essentially, it has a fundamental transport rate of 51.84Mb/s (an STS-1 or OC-1 frame consists of 90x9 bytes x 8bits/byte x 8000 frames/s = 51.84Mb/s). By multiplexing 'N' number of the STS-1 frames can create an STS-N frame; thus increasing 'N' times the data rate with the currently defined level corresponding to the following values of N: (1, 3, 12, 48, 196). The STS-1 consists of two parts, the STS payload which carries the data and the STS overhead which carries the signaling and protocol information. One of the important features in the STS overhead is that it always provides a pointer value that knows exactly where the beginning of a framed packet resides within the STS frames.

The most important feature of SONET standard is that all clocks in the networks are locked to a common clock, so that simple time-division multiplexing scheme can be used. Multiplexing in SONET is done by byte-interleaving. Because of the synchronous property that SONET provide, it also simplifies multiplexing/demultiplexing of individual data streams. To be more specific, SONET allows data streams of different formats to be combined into a single high-speed fiber optic synchronous data stream. Furthermore, SONET is 'backward compatible' in a sense that it can transport lower signal rate such as the T-1 carrier by North America and E-1 carrier in Europe. SONET frame structure is also 'forward compatible' in that it can support the transport of ATM cells. It also provides advanced network management and maintenance features in which 5% of the total bandwidth is devoted to this.

SONET is governed by 4 protocol layers (photonic, section, line, and path layers). These layers work closely with the various SONET physical components: Byte-interleaved multiplexer - byte-interleave various data streams into a STS-N frame. Regenerators - retime, reshape, and retransmit the signals. Add/Drop multiplexer - adding and dropping signals. This is all done in a comprehensive Terminal-to-Terminal transmission, which is all part of the SONET physical components. These SONET physical components are actually being deployed in a SONET ring architecture. The basic idea is that one set of fiber(s) carries the working ring in service while the other set of fiber(s) is used as a standby or protection in case if there is a fiber cut or node failure. Because of its reliability, flexibility, and expandability, the SONET ring architecture is widely deployed across the U.S. continent.