Course Name: A Level (2nd Sem)   Subject: DCN

Topic: SONET/SDH   Date: 09-06-20

SONET/SDH:

SONET is a wide area network (WAN) technology (based on fiber optics) that is used as a transport network to carry loads from other WANs. The ANSI standard is called the Synchronous Optical Network (SONET). The ITU-T standard is called the Synchronous Digital Hierarchy (SDH). In other words, SONET was developed by ANSI; SDH was developed by ITU·T. Both are fundamentally similar and ultimately compatible.

Architecture:

The architecture of a SONET system can be explained on the basis of: **signals**, **devices**, and **connections**.
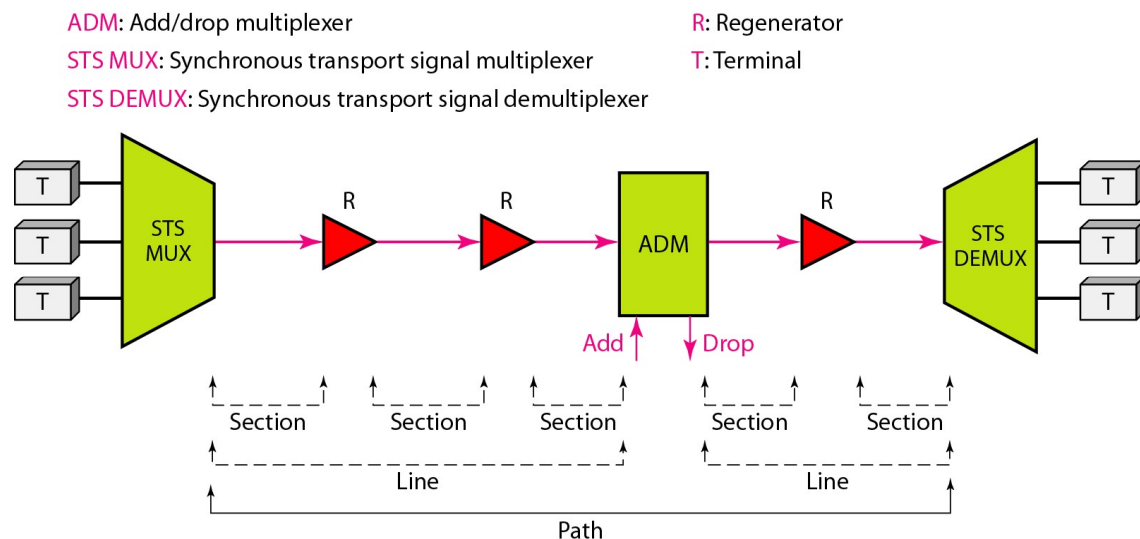
Signals:

SONET defines a hierarchy of electrical signaling levels called **synchronous transport signals (STSs)**. Each STS level (STS-1 to STS-192) supports a certain data rate, specified in megabits per second. The corresponding optical signals are called **optical carriers (OCs)**. SDH specifies a similar system called a synchronous transport module (STM). STM is intended to be compatible with existing European hierarchies, such as E lines, and with STS levels. To this end, the lowest STM level, STM-1, is defined as 155.520 Mbps, which is exactly equal to STS-3.

STS	OC	Rate (Mbps)	STM
STS-1	OC-1	51.840	
STS-3	OC-3	155.520	STM-1
STS-9	OC-9	466.560	STM-3
STS-12	OC-12	622.080	STM-4
STS-18	OC-18	933.120	STM-6
STS-24	OC-24	1244.160	STM-8
STS-36	OC-36	1866.230	STM-12
STS-48	OC-48	2488.320	STM-16
STS-96	OC-96	4976.640	STM-32
STS-192	OC-192	9953.280	STM-64

SONET Devices:

Figure shows a simple link using SONET devices. SONET transmission relies on three basic devices: STS multiplexers/demultiplexers, regenerators, add/drop multiplexers and terminals.

- **STS Multiplexer/Demultiplexer:** STS multiplexers/demultiplexers mark the beginning points and endpoints of a SONET link. They provide the interface between an electrical tributary network and the optical network. An STS multiplexer multiplexes signals from multiple electrical sources and creates the corresponding OC signal. An STS demultiplexer demultiplexes an optical OC signal into corresponding electric signals.

- **Regenerator:** Regenerators extend the length of the links. A regenerator is a repeater that takes a received optical signal (OC-n), demodulates it into the corresponding electric signal (STS-n), regenerates the electric signal, and finally modulates the electric signal into its correspondent OC-n signal. A SONET regenerator replaces some of the existing overhead information (header information) with new information.

ADM: Add/drop multiplexer   R: Regenerator
STS MUX: Synchronous transport signal multiplexer   T: Terminal
STS DEMUX: Synchronous transport signal demultiplexer

- **Add/drop Multiplexer (ADM):** Add/drop multiplexers allow insertion and extraction of signals. It can add STSs coming from different sources into a given path or can remove a desired signal from a path and redirect it without demultiplexing the entire signal. Add/drop multiplexers use header information such as addresses and pointers to identify individual streams. In the simple configuration shown by Figure, a number of incoming electronic signals are fed into an STS multiplexer, where they are combined into a single optical signal. The optical signal is transmitted to a regenerator, where it is recreated without the noise it has picked up in transit. The regenerated signals from a number of sources are then fed into an add/drop multiplexer. The add/drop multiplexer reorganizes these signals, if necessary, and sends them out as directed by information in the data

frames. These demultiplexed signals are sent to another regenerator and from there to the receiving STS demultiplexer, where they are returned to a format usable by the receiving links.

- **Terminals:** A terminal is a device that uses the services of a SONET network. For example, in the Internet, a terminal can be a router that needs to send packets to another router at the other side of a SONET network.

Connections

The devices defined in the previous section are connected using sections, lines, and paths.

- **Sections:** A section is the optical link connecting two neighbor devices: multiplexer to multiplexer, multiplexer to regenerator, or regenerator to regenerator.

- **Lines:** A line is the portion of the network between two multiplexers: STS multiplexer to add/drop multiplexer, two add/drop multiplexers, or two STS multiplexers.

- **Paths:** A path is the end-to-end portion of the network between two STS multiplexers. In a simple SONET of two STS multiplexers linked directly to each other, the section, line, and path are the same.

Exercises:

1. What is the relationship between SONET and SDH?
2. What is the relationship between STS and STM?
3. How is an STS multiplexer different from an add/drop multiplexer since both can add signals together?
4. What is the relationship between STS signals and OC signals?
5. Why is SONET called a synchronous network?
6. What is the function of a SONET regenerator?