
Section [6]: Introduction to Telecommunications

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This is the first in a series of articles about the Public Switched Telephone Network as it functions in the United States and Canada. The purpose of the series is to expand the horizons of any individual who desires to increase their awareness of how all these machines that are connected to each other function together as a network.

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On With the show...

In the Science of telecommunications there are two major sub-sciences that work as a team to get the job done. They are ***Transmission*** and ***Switching***. Transmission will be covered in the first few issues. Switching will be briefly defined but basicly dealt with later.

Transmission is not a gear box as far as this series is concerned. It is the Transport of an electrical or accoustic energy (message) from one point to another. In its simplest applications it is copper wire. Due to the basic concept of Ohms Law & attenuation the range of wire alone is somewhat limited. The only thing I know of that has a wider bandwidth for direct connection is optical cable. The need to send a signal greater than it was possible using wire alone caused the evolution of several generations of increasingly sophisticated transmission systems. The greed asociated with money added motivation to continue to develop systems that would increase the throughput of existing transmission components thereby cutting costs, and since our utility bills never go down if a Telco (Telephone Company) can cut operating cots their profit just goes up.

By far one of the most important concepts that will serve as a foundation

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of enlightenment in this series is that of Digital Transmission with the MOST PREVAILING FORMAT being **** T1 ***** sometimes referred to as DS1.

A T1 circuit is basically a pipe that goes from one location to another to pass telephone calls, and or Private line Data Services Back and forth. In common applications it contains 24 telephone lines in a digital format. The format is serial synchronous in nature with a line rate of 1,544,000 bits per second. Hauling ass compared to 14,400 huh?

T1 ckts are used mostly to tie a Telephone Company Switch in one location to a switch in another location. Their use is also on the rise for Private Point to Point Communication in virtually endless possible applications. Most of the larger Telcos and LD Carriers now offer Line Services to Larger Commercial Customer in Metro areas in a T1 lie format.

Many great enhancements with few drawbacks came with the introduction of T1 technology in the early 70s. Line noise has all but disappeared in most connections useing the larger carriers. If we time warped 2 hst modems back to 1955 we would be lucky to get a 2400 baud connect. It also brought about the ability to call coast to coast without spending a fortune. They dont require as much maintenance as analog networks so zillions of jobs went away through the years.

One of the requested topics has been that of wire taps. T1 has made this a lot easier to implement and nearly impossible to detect by the tapped party. In nearly 90% of the USA a telephone signal is analog for a short distance on each end of the connection, From the serveing Telco to the telephone set or modem. A digital signal is the easiest to monitor with no affect on the analog lines. A digital test set with an impedance of 1000 ohms on the input will not even cause a click when the test cord is inserted in the jack. most digital switches provide for Maintenance monitoring of analog lines by electronicly bridgeing a D to A convertor to the line just after it is converted to digital from analog in the transmit direction and just before it is converted from digital to analog in the receive direction. Bottom line is that anyone who can gain the cooperation of the telephone company with or without a court order can eavesdrop without haveing any affect at all on the circuit that goes out to the telephone set. This total circuit isolation makes it impossible to detect this kind of tap.

There are many So Called Tap detectors on the market. They function on the premise of detecting abnormal voltage or current levels associated with the line inbetween the serving telephone company and the users phones. They are incapable of detecting any thing beyond the first line transformer.

In effect even without telco help it is very easy to insert a device any where in the line betwwen the phone & the telco that can isolate the phone side of the circuit and allow monitoring equipment to be attached with no

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side affects to your line. Such devices can even be field calibrated so that all voltage and attenuation characteristics that were present prior to its installation are repeated towards the phone. They can be adjusted to within a millivolt for the DC characteristics an .05 db for the analog characteristics.

At the risk of gossiping about the many law enforcement agencies that might try to tap a line I have an opinion or two.

1. If the Feds want to listen they probably will, you cant tell, and if they are that interested you are probably toast any way, they are just trying to find out who your associates are by listening.
2. Many States, Counties, Large Cities & even a few Fed agencies can contract with individuals who have the equipment needed to do this kind of dirty work.
3. Most small town or county agencies would be likely to try it with an analog tap that a third grader could find with a multimeter. 20 bucks & a trip to Radio Shack would probably do the trick on building a gizmo that would make a light go on if someone tried a crude tap.

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