Transmission systems and techniques (Lecture 26.9/ML)

Plesiochronous Digital Hierarchy (PDH) is a transmission system for ’voice communication’ using plesiochronous synchronization. PDH can be (and is) used for data transmission. However, technology is optimized for transportation of PCM coded voice *(see course book pages 70−77 about information of PCM coding)*.

PDH uses time division multiplexing (TDM) to control and to share resources of transmission line. Connections in PDH systems are identified by their respective positions in PDH frame *(see pages 97−98 about position multiplexing).*

PDH E1 (basic rate PDH) uses 32 time−slot frame structure where each slot is 8 bits (i.e. one PCM coded voice sample). Frames are sent on every 125us (inter−sample time in PCM coding). 30 time−slots are used for information transfer and 2 for control purposes (i.e. TS 0 and TS 16). Therefore basic rate of PDH E1 is 8000Hz*8bits*32=2048 kbps. PDH hierarchy is based on multiplexing four lower level signals into one higher level signal. However, bit−rate is not exact multiple of lower speed: 2048 −> 8448 −> 34368 −> 139264. This is due to additional control information which is added on higher stages of multiplexing. *(see course book pages 214−219 about PDH)*.

Synchronous Digital Hierarchy (SDH) is an international digital telecommunications network hierarchy which standardizes transmission from 155Mbps to 10Gbps. SDH is general purpose transport system which is not optimized to any particular purpose. However, it still carries dependencies to the old PCM and PDH world (i.e. Frames are generated on every 125us and they are tiled to 8bit pieces). Frame in SDH is called as STM−1 (Synchronous Transport Module−Level 1). STM−1 frame size is 2430*8bits and it is best viewed as 9 times 270 matrix. First 9x9 bytes are header information which is used for control purposes.

The SDH specifies how payload data is framed and transported synchronously across optical fiber transmission links without requiring all the links and nodes to have the same synchronized clock for data transmission and recovery (i.e. both the clock frequency and phase are allowed to have variations, or be plesiochronous). SDH offers several advantages over the PDH. Where PDH lacks built−in facilities for automatic management and routing, and locks users into proprietary methods, SDH can improve network reliability and performance, offers much greater flexibility and lower operating and maintenance costs, and provides for a faster provision of new services. *(see course book pages 219−227 about SDH)*

You’ll find a short tutorial on SONET/SDH at the Queen’s University of Belfast.
http://www.pcc.qub.ac.uk/tec/courses/network/SDH−SONET/sdh−sonetV1.1a_1.html

Synchronization In digital telephone transmission, "synchronous" means the bits from one call are carried within one transmission frame. "Plesiochronous" means "almost (but not) synchronous," or a call that must be extracted from more than one transmission frame. In synchronization plan operator decides how timing information is spread all over the network. There are some timing requirements which needs to be met if overflowing of reception buffer are wanted to avoid (i.e. Frame slips where single frame is lost due to clock differences in transmitter and receiver) *(see course book pages 435−440about synchronization)*