Chap 10 The Telephone System

Three components – Subscriber loop, switching system, and long-haul carrier.
Subscriber loop – the twisted wire pair
Switching system – Cross-bar switch, ESS-8
Long-Haul System – Microwave and optical fibers

Structure of Switched Network
Local Access and Transport Area (LATA) Subscriber – Central Office – Tandem Office
Long Distance – Toll Center, Primary Center, Secondary Center, Sectional Center, Regional Center

Twisted Wire Pair – Limited bandwidth, phase distortion; Loading improves the frequency response.
Local Loop – Ring, tip; on and off hook, ringer coil
Touch Tone Pad – Dual-tone multifrequency dialing
Crosspoint Switch – Space or circuit switching
The phone set – Audio transceiver, DTMF, ringer, power supply (MC34011A)

Noise in the phone system – Reflection, via net loss and echo suppression (echo canceller)
C-message weighing – The reference noise level

Frequency-Division Multiplexing – Group, Supergroup, Master Group

Chapter 11 Digital Communications
Digital and Analog Channels
Modem – D/A or A/D
Frequency – Baseband or Modulated
Digital – CODEC

Digital Signaling – S/N, Threshold, BER
Repeater – Regeneration, Reshaping, and Retiming
Channel Information Capacity – Shannon and Hartley theorem: C=2B\log_2 M
Shannon Limit: C=2B\log_2(1+S/N)
Analog Pulse Modulation – PAM, PDM, PPM (amplitude, duration, and position)
Digital Pulse Modulation – PCM
A/D – Sampling and Quantization (aliasing and quantization error)
Mu-Law Compression – To enhance small signal and reduce quantization error

\[ v_o = \frac{V_o \ln(1 + v_i/V_o)}{\ln(1 + v_i/V_o)} \]

Delta Modulation – Transmit the difference
Digitization – Low pass filter, sample-and-hold, A/D, parallel to serial
CODEC or Combo Chip
Digitized Voice – 8k sampling, 8-bit quantization; 64kB/sec
Digital Signal Hierarchy – T1 (64kB/sec, 24 channels), T2 (4xT1), T3 (7xT2), T4 (6xT3)
Line Code – Unipolar NRZ, Bipolar NRZ, AMI RZ, Manchester Code
Digital Switching – Time switching
Integrated Services Digital Network (ISDN)
  Limited distance
  2 pairs of twisted wires
  2x64kb/sec bearer channels
  1x64kb/sec data channels (control)
  Analog equipment needs an interface
MPEG Video Compression
  Nominal digital video data rate:  270 Mb/sec
  MPEG-1:     1.5 Mb/sec
  MPEG-2:     3 Mb/sec
    I frames, 8x8 discrete cosine transform
    16x16 predicted frame or bi-directional frame
    20:1 compression ratio

Homework Assignments: 29, 31