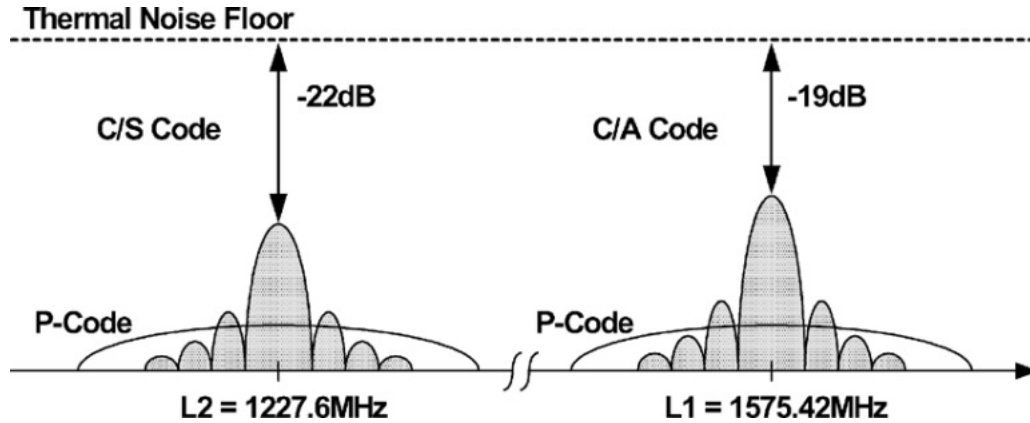




# Digital Signal Processing (DSP)

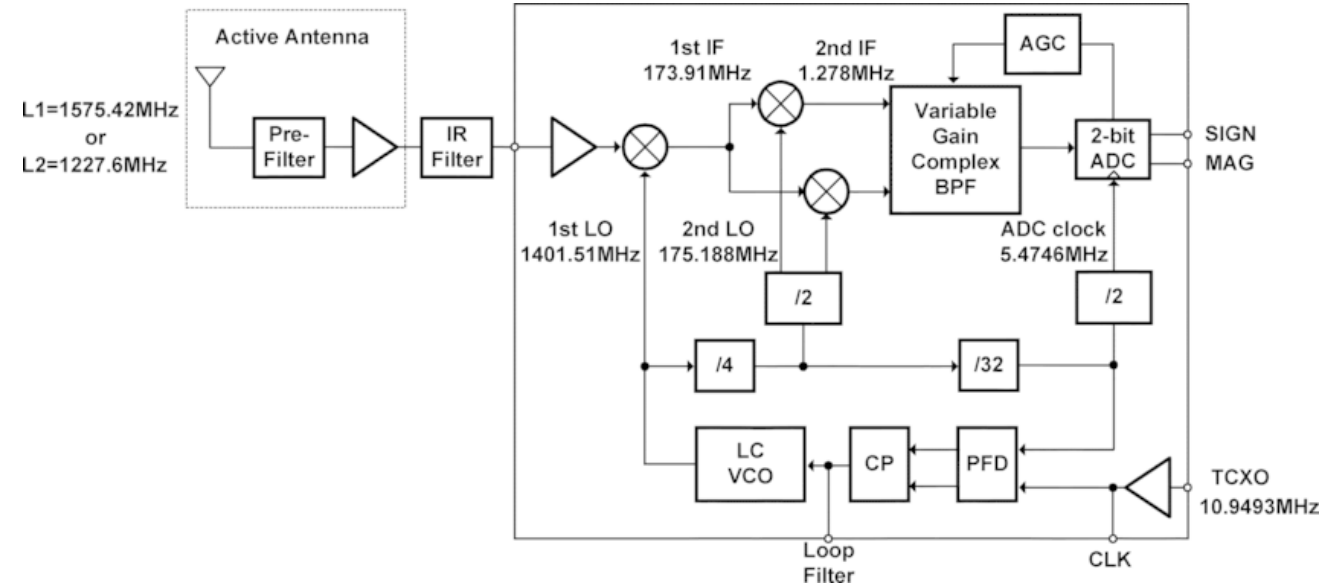
ECE 3640

# GPS Receiver



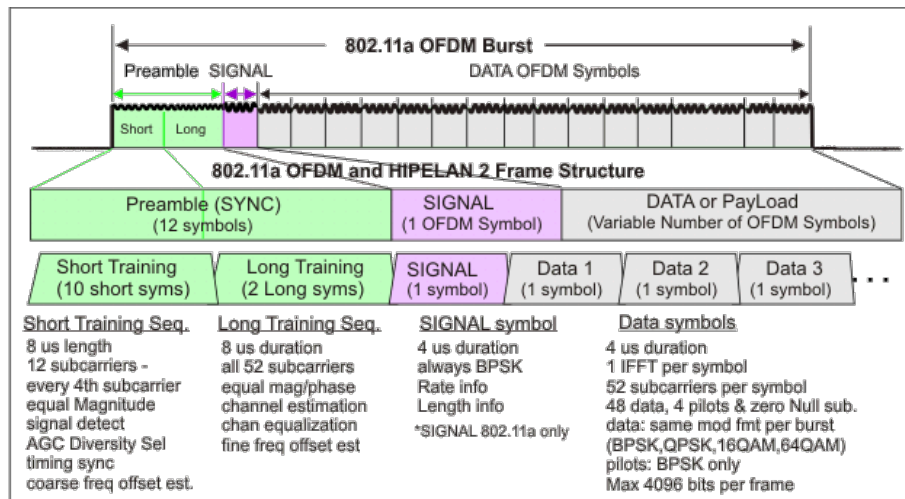
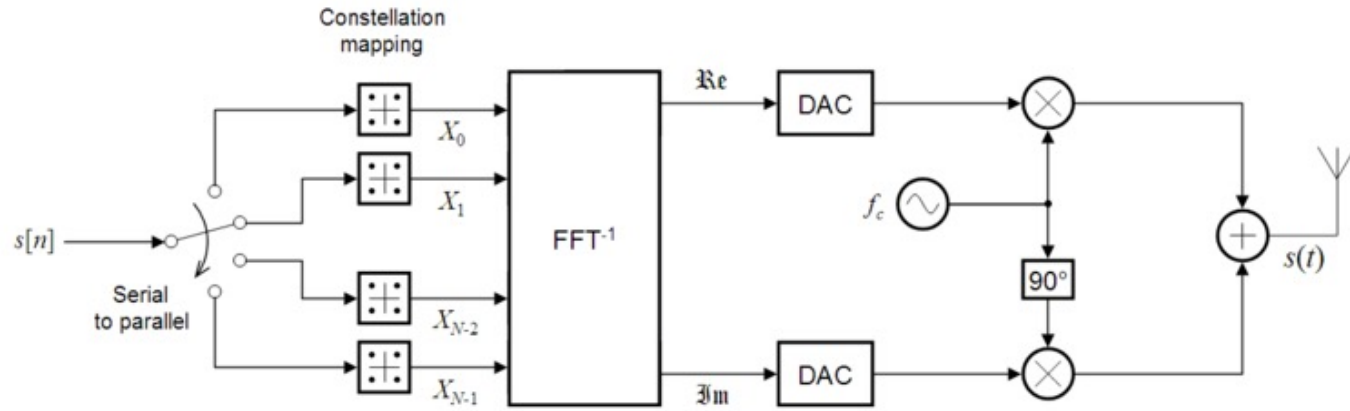
L1 AND L2 SIGNAL CHARACTERISTICS

	L1 band	L2 band
Carrier frequency	1575.42 MHz	1227.6 MHz
Multiples of chip-rate	1540	1200
Power	-130 dBm	-133 dBm
PRN Code	C/A, P	C/S, P
Data rate (R <sub>b</sub> )	50 bps	25 bps
Chip rate (f <sub>c</sub> )	1.023 Mcps	1.023 Mcps
C/No	44 dB-Hz	41 dB-Hz
S/N (2MHz bandwidth)	-19 dB	-22 dB

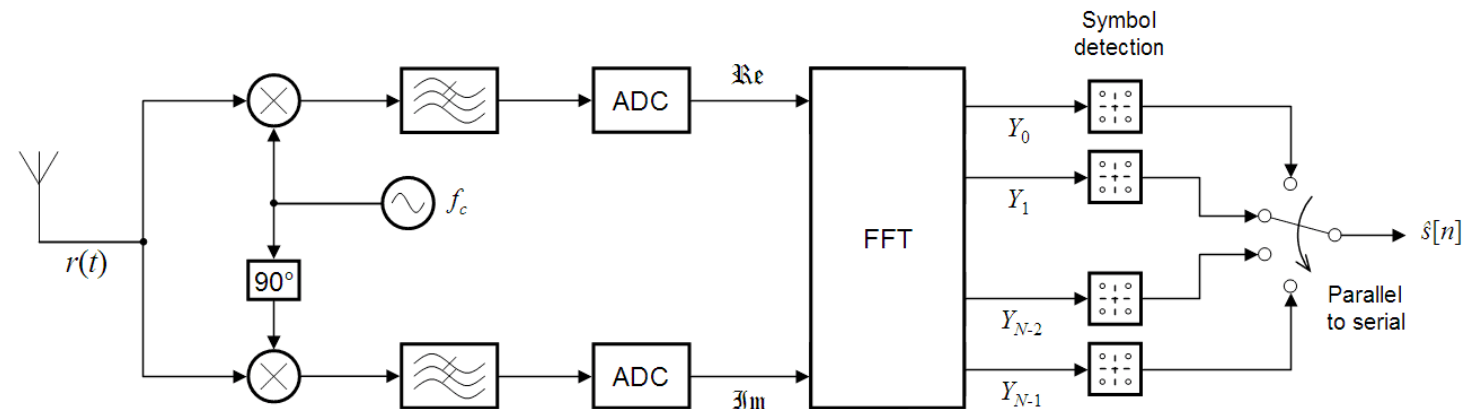


Ko, Jinho & Kim, Jongmoon & Cho, Sanghyun & Lee, Kwyro. (2005). A 19-mW 2.6-mm/sup 2/ L1/L2 dual-band CMOS GPS receiver. Solid-State Circuits, IEEE Journal of. 40. 1414 - 1425. 10.1109/JSSC.2005.847326.

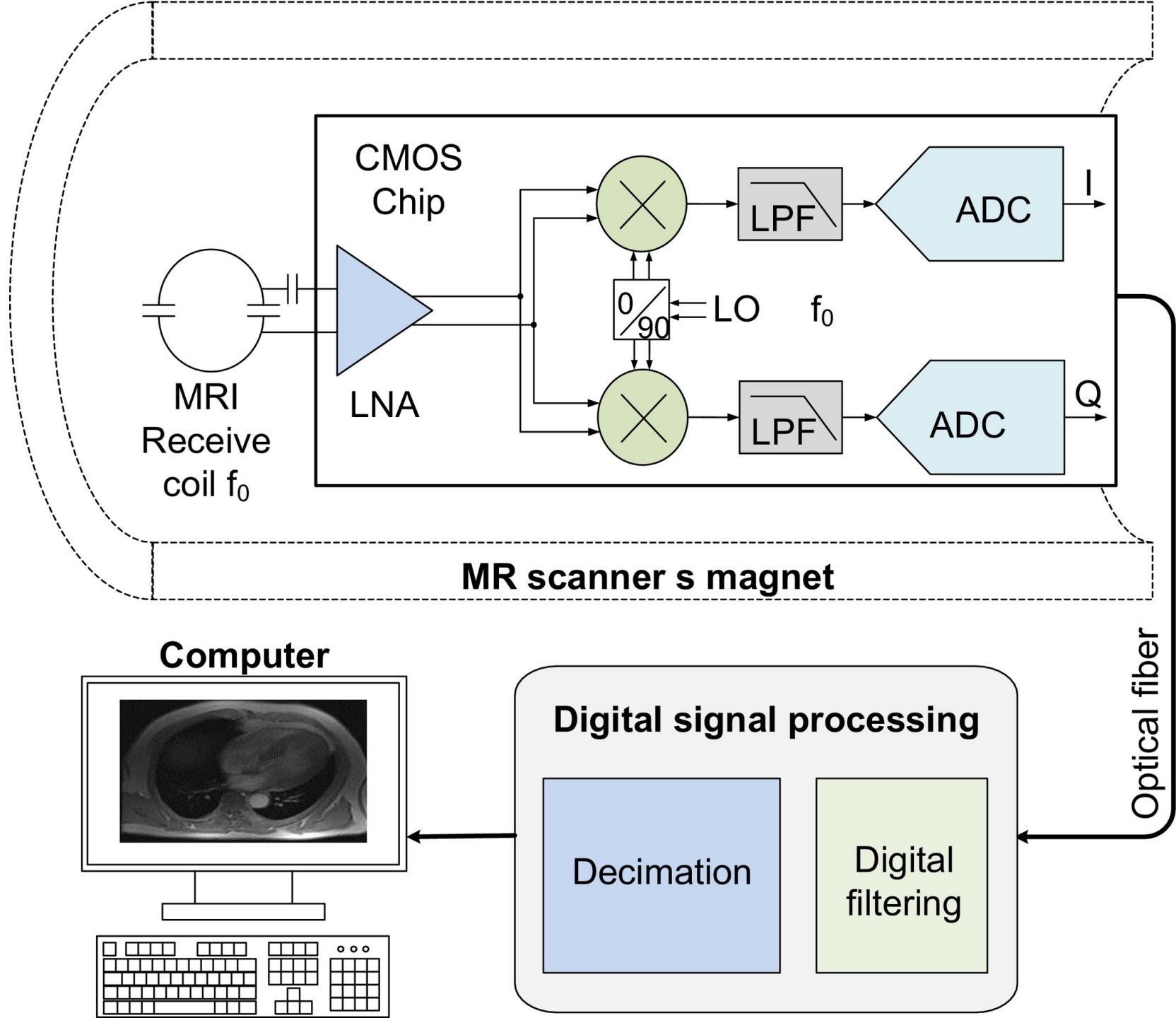
# IEEE 802.11a – Wireless Networking



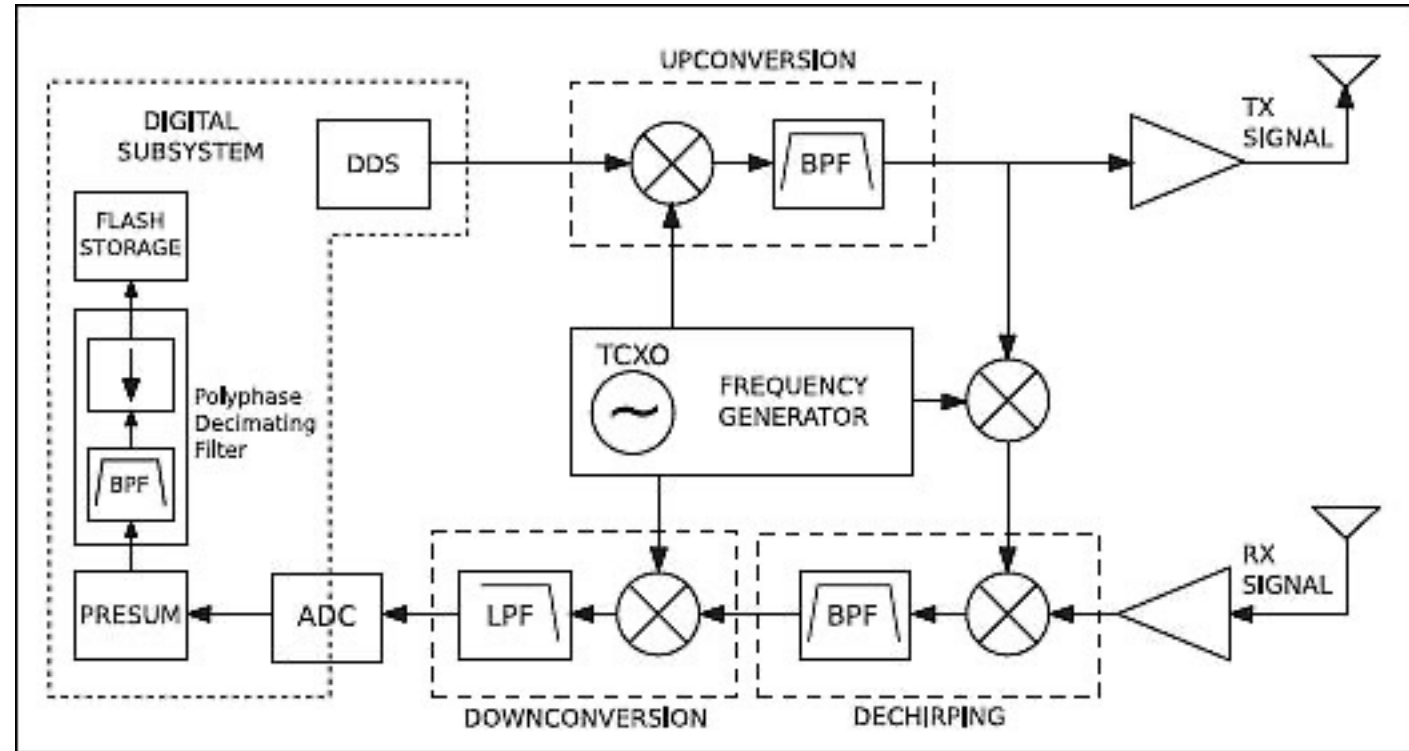
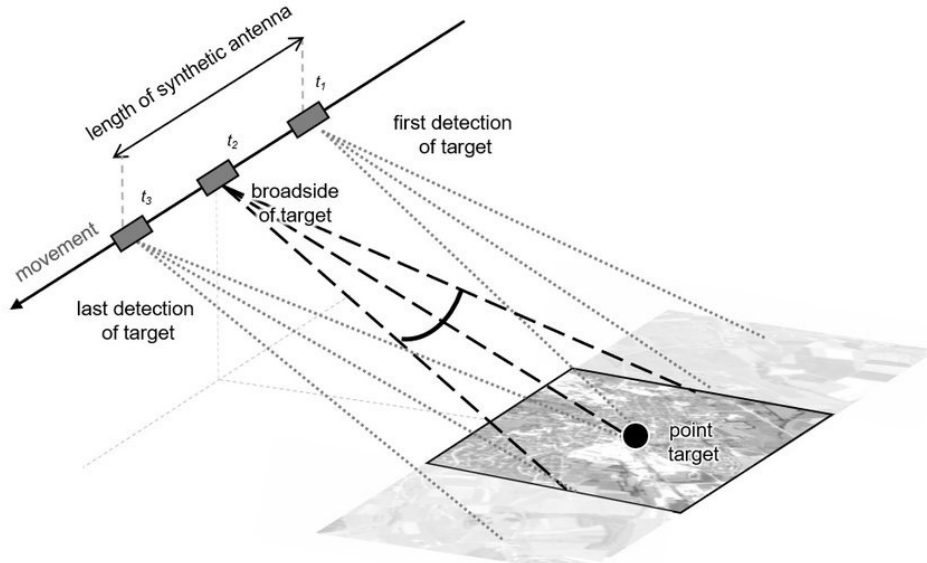
802.11a and HIPERLAN/2 Frame Structure



# Magnetic Resonance Imaging (MRI)

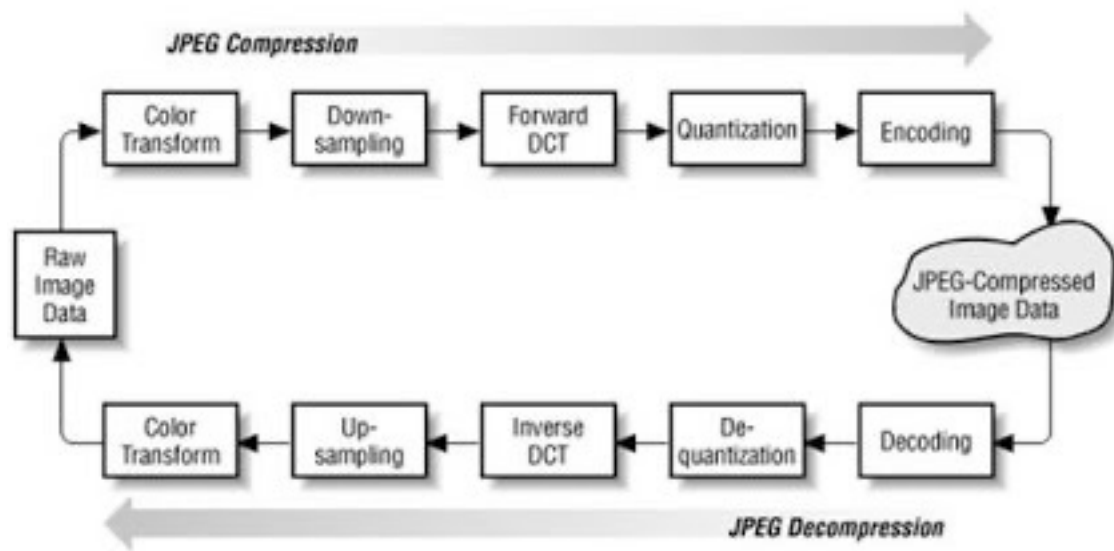


# Synthetic Aperture Radar (SAR)

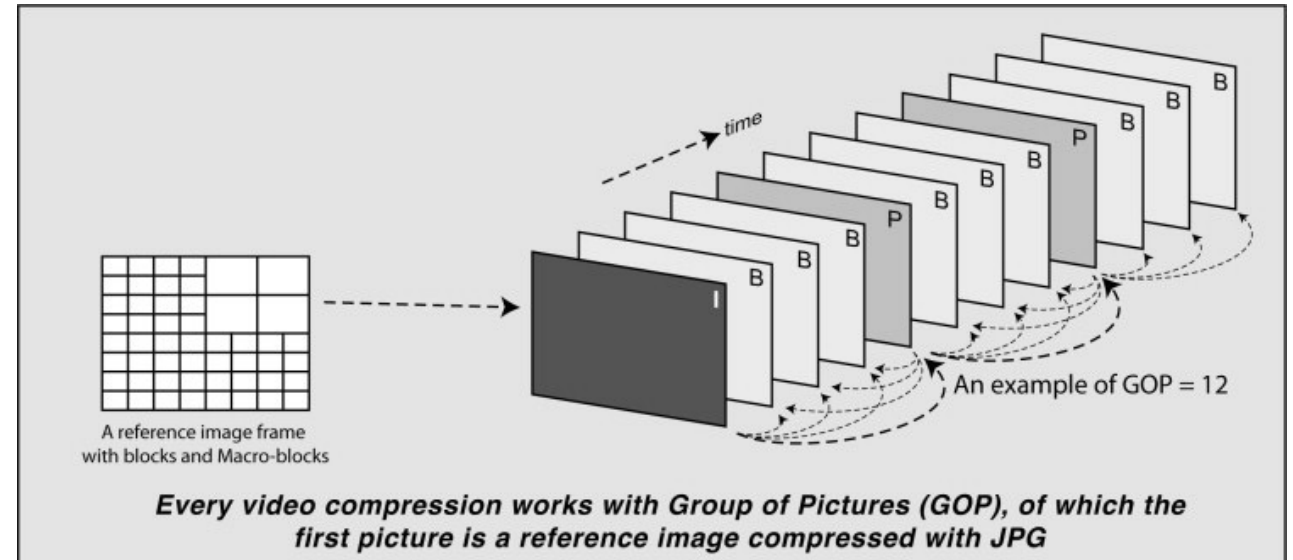


# Data Compression (image, speech, music, video)

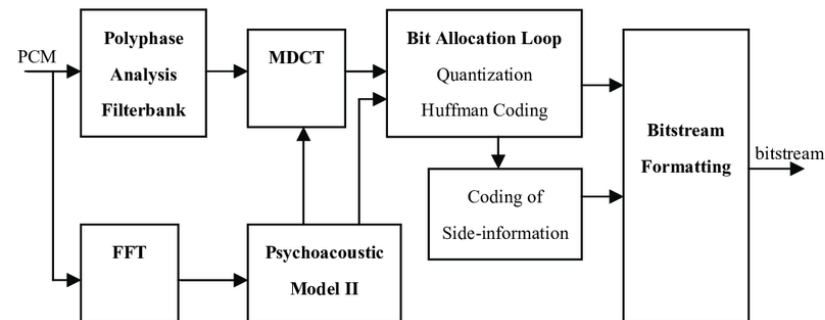
## JPEG Compression



## MPEG Compression



## MP3 Compression



# Applications of DSP

- Navigation (GPS, GNSS, etc.)
- Communication (cellular, WiFi, Bluetooth, fiberoptic, multiplexing, echo cancellation, noise cancellation, secure communication, etc.)
- Compression (music, speech, images, video, general data, etc.)
- Medicine (MRI, CT, ultrasound, heart-ECG and brain-EEG signals, etc.)
- Medical devices (hearing aids, etc.)
- Defense (radar, sonar, SAR, detection, electronic warfare, etc.)
- Autonomy and control (sensors, feedback control, etc.)
- Science (oil and mineral prospecting, earthquake monitoring, etc.)

# DSP is Ubiquitous

Basic operations and what is covered in ECE 3640:

- Filters (low pass, bandpass, high pass, adaptive, predictive, matched)
- Mixers (frequency shifting)
- Oscillators (sin, cos,  $e^j$ )
- Transforms (FFT, DCT, wavelet)
- Sampling & reconstruction (A/D, D/A)
- Sample rate conversion (upsampling, downsampling)
- Filterbanks
- Feedback (AGC, PLL, control systems)