1-11-07

802.11 Protocol Stack

Infrared | FHSS | DSSS | a OFDM | b HR-DSSS | g OFDM

ISM Band
Industrial/Scientific/Medical

902 - 928 MHz

b, g
2400 - 2483.5 MHz ←

a
5725 - 5850 MHz
FHSS
Frequency Hopping Spread Spectrum
2.4 GHz - 79 channels
Each 1 MHz wide

DSSS
Direct Sequence SS
CDMA (Similar)
Code Division Multiple Access
1-2 Mbps
Each bit in short intervals
64 or 128 Chips

Example: 8 Chips for a bit

A: 00011011
B: 00101110
C: 01011100
D: 01000010

Bipolar representation

A: (-1 -1 -1 +1 +1 -1 +1 +1)

\[ S \cdot T = \frac{1}{m} \sum_{i=1}^{m} S_i T_i = 0 \]
\[ A = \frac{1}{8}(0+0+0+0) \]
\[ B = (-1 -1 +1 -1 +1 +1 +1 -1) \]
\[ A \cdot B = \frac{1}{8}(+1+1-1-1+1-1+1-1) \]
\[ = \frac{1}{8} \cdot 0 = 0 \]
\[ B \cdot B = 1 \]

**Orthogonal**

**DSSS** - 11 Chips per bit

**Barker Sequence**

**HR-DSSS** - High Rate
802.11 b

11 million chips/sec

→ 1 Mbps in 2.4 GHz

Data rates

1, 2, 5.5, 11 Mbps

1.375 M baud

4 or 8 bits per baud

5.5 11 Mbps
802.11 a and g

OFDM

Orthogonal Frequency Division Multiplexing

52 different frequencies

48 for data  4 for synchronization

Complex encoding scheme

based on

Phase Shift Modulation

upto 18 Mbps

Quadrature Amplitude Modulation

216 data bits encoded in 288 bit
Ethernet - CSMA/CD
Hidden Station Problem

A

B

C is transmitting to B
Exposed Station Problem

A is transmitting
B wants to transmit

Error Rate

CSMA/CA
Two modes of operation

DCF - Distributed Coordination Function

PCF - Point Coordination Function