IEEE Standards					
	802.11a	802.11b	802.11g	802.11n	
Maximum Throughput	54 Mbps	11 Mbps	54 Mbps	300 Mbps	
Frequency	5 GHz	2.4 GHz	2.4 GHz	2.4/5 GHz	
Modulation	OFDM	DSSS	DSSS/OFDM	OFDM	
Channels (FCC/ETSI)	21/19	11/13	11/13	32/32	
Ratified	1999	1999	2003	2009	

# **WLAN Types**

#### **Ad Hoc**

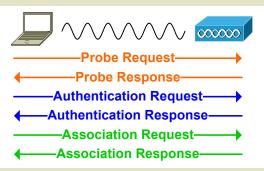
A WLAN between isolated stations with no central point of control; an IBSS

#### Infrastructure

A WLAN attached to a wired network via an access point; a BSS or ESS

Frame Types				
Туре	Class			
Association	Management			
Authentication	Management			
Probe	Management			
Beacon	Management			
Request to Send (RTS)	Control			
Clear to Send (CTS)	Control			
Acknowledgment (ACK)	Control			
Data	Data			

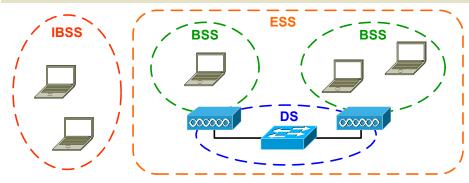
#### **Client Association**



Modulations

Modulations				
Scheme	Modulation	Throughput		
DSSS {	DBPSK	1 Mbps		
	DQPSK	2 Mbps		
	CCK	5.5/11 Mbps		
OFDM {	BPSK	6/9 Mbps		
	QPSK	12/18 Mbps		
	16-QAM	24/36 Mbps		
	64-QAM	48/54 Mbps		

# **WLAN Components**



#### **Basic Service Area (BSA)**

The physical area covered by the wireless signal of a BSS

#### **Basic Service Set (BSS)**

A set of stations and/or access points which can directly communicate via a wireless medium

#### Distribution System (DS)

The wired infrastructure connecting multiple BSSs to form an ESS

#### **Extended Service Set (ESS)**

A set of multiple BSSs connected by a DS which appear to wireless stations as a single BSS

# **Independent BSS (IBSS)**

An isolated BSS with no connection to a DS; an ad hoc WLAN

# **Measuring RF Signal Strength**

#### Decibel (dB)

An expression of signal strength as compared to a reference signal; calculated as  $10\log_{10}(\text{signal/reference})$ 

dBm · Signal strength compared to a 1 milliwatt signal

**dBw** · Signal strength compared to a 1 watt signal

dBi · Compares forward antenna gain to that of an isotropic antenna

# Terminology

# **Basic Service Set Identifier (BSSID)**

A MAC address which serves to uniquely identify a BSS

### **Service Set Identifier (SSID)**

A human-friendly text string which identifies a BSS; 1-32 characters

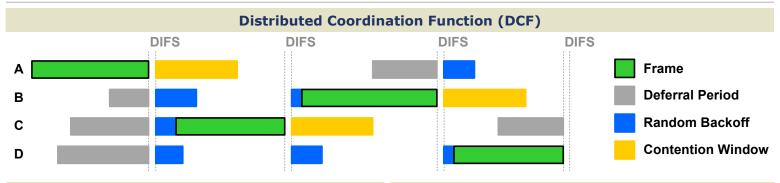
# Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA)

The mechanism which facilitates efficient communication across a shared wireless medium (provided by DCF or PCF)

# **Effective Isotropic Radiated Power (EIRP)**

Net signal strength (transmitter power + antenna gain - cable loss)

by Jeremy Stretch v2.2



#### **Interframe Spacing**

## **Short IFS (SIFS)**

Used to provide minimal spacing delay between control frames or data fragments

# DCF IFS (DIFS)

Normal spacing enforced under DCF for management and non-fragment data frames

## **Arbitrated IFS (AIFS)**

Variable spacing calculated to accommodate differing qualities of service (QoS)

#### **Extended IFS (EIFS)**

Extended delay imposed after errors are detected in a received frame

### **Encryption Schemes**

#### Wired Equivalent Privacy (WEP)

Flawed RC4 implementation using a 40- or 104-bit pre-shared encryption key (deprecated)

#### Wi-Fi Protected Access (WPA)

Implements the improved RC4-based encryption Temporal Key Integrity Protocol (TKIP) which can operate on WEP-capable hardware

# IEEE 802.11i (WPA2)

IEEE standard developed to replace WPA; requires a new generation of hardware to implement significantly stronger AES-based CCMP encryption

Quality of Service Markings				
WMM	802.11e	802.1p		
Platinum	7/6	6/5		
Gold	5/4	4/3		
Silver	3/0	0		
Bronze	2/1	2/1		

#### Wi-Fi Multimedia (WMM)

A Wi-Fi Alliance certification for QoS; a subset of 802.11e QoS

#### **IEEE 802.11e**

Official IEEE WLAN QoS standard ratified in 2005; replaces WMM

# **IEEE 802.1p**

QoS markings in the 802.1Q header on wired Ethernet

#### **Client Authentication**

Open · No authentication is used

### **Pre-shared Encryption Keys**

Keys are manually distributed among clients and APs

# Lightweight EAP (LEAP)

Cisco-proprietary EAP method introduced to provide dynamic keying for WEP (deprecated)

#### **EAP-TLS**

Employs Transport Layer Security (TLS); PKI certificates are required on the AP and clients

# **EAP-TTLS**

Clients authenticate the AP via PKI, then form a secure tunnel inside which the client authentication takes place (clients do not need PKI certificates)

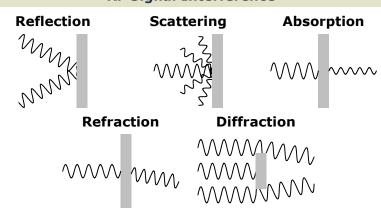
# **Protected EAP (PEAP)**

A proposal by Cisco, Microsoft, and RSA which employs a secure tunnel for client authentication like EAP-TTLS

## **EAP-FAST**

Developed by Cisco to replace LEAP; establishes a secure tunnel using a Protected Access Credential (PAC) in the absence of PKI certificates

# **RF Signal Interference**



#### **Antenna Types**

**Directional** · Radiates power in one focused direction

#### **Omnidirectional**

Radiates power uniformly across a plane

## **Isotropic**

A theoretical antenna referenced when measuring effective radiated power

by Jeremy Stretch v2.2