IEEE 802.11 WLAN · Part 1

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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

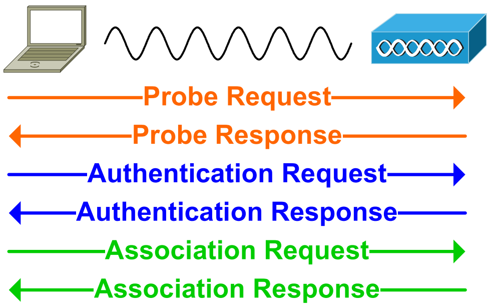
Ad Hoc
A WLAN between isolated stations with no central point of control; an IBSS

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

Frame Types

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

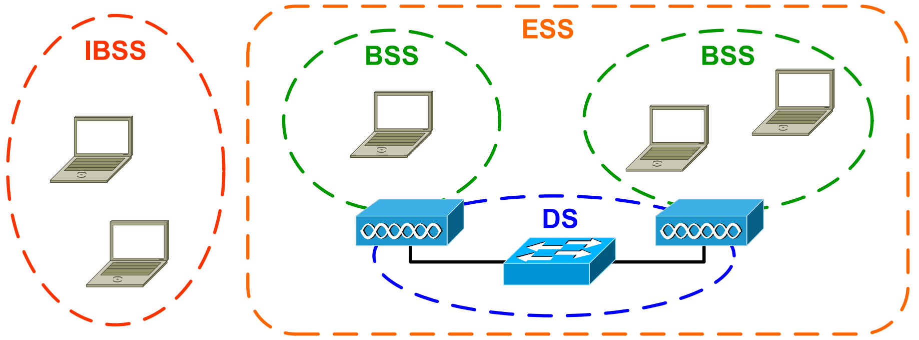
Client Association



Modulations

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 $10\log_{10}$(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)

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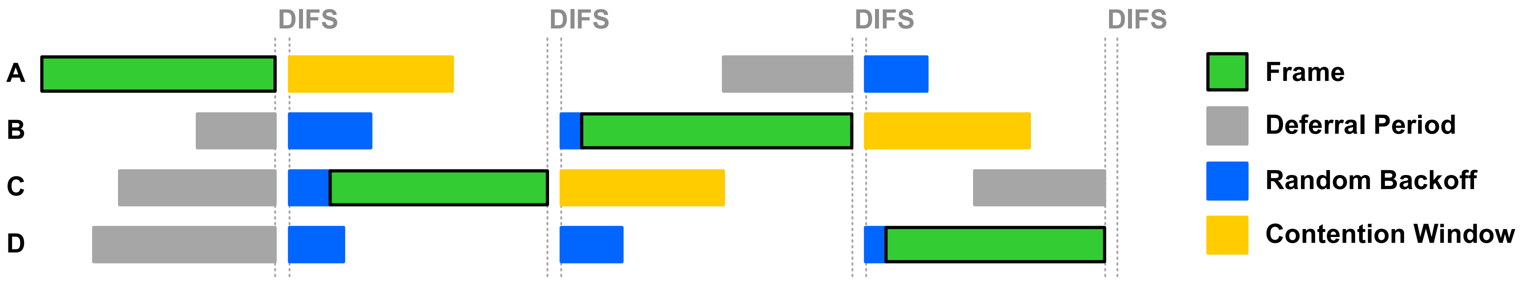
Distributed Coordination Function (DCF)



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)

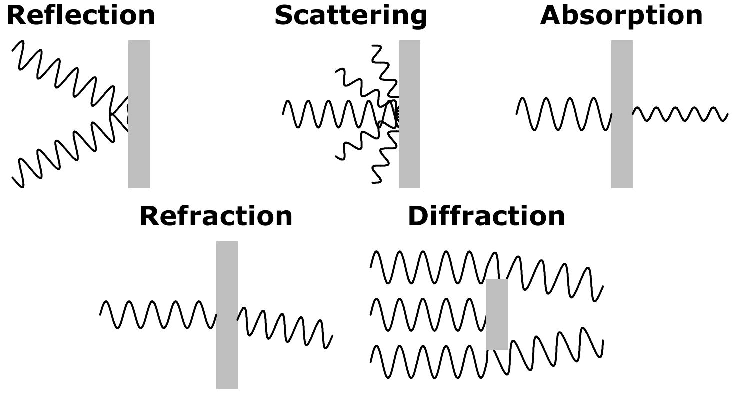
EAP-TLS
Employs Transport Layer Security (TLS); PKI certificates are required on the AP and clients

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



Reflection **Scattering** **Absorption**

Refraction **Diffraction**

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

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