









Wir	eless LAN F	Reguiremer	nts
	THROUGHPUT – should make efficient use of medium	NUMBER OF NODES- hundreds of nodes across multiple cells	CONNECTIONTO BACKBONE LAN – use of control modules
	SERVICE AREA – coverage area of 100 to 300m	BATTERY POWER CONSUMPTION – reduce power consumption while not in use	TRANSMISSION ROBUST AND SECURITY- reliability and privacy/security
	COLLOCATED NETWORK OPERATION – possible interference between LANs	LICENSE-FREE OPERATION – not having to secure a license for the frequency band used by the LAN	HANDOFF/ROAMING- enable stations to move from one cell to another
	DYNAMIC CONFIGURATION- addition, deletion, relocation of end systems without disruption		



Standard	Scope	
	Medium access control (MAC): One common MAC for WLAN applications	
IEEE 802.11	Physical layer: Infrared at 1 and 2 Mbps	
	Physical layer: 2.4-GHz FHSS at 1 and 2 Mbps	
	Physical layer: 2.4-GHz DSSS at 1 and 2 Mbps	
IEEE 802.11a	Physical layer: 5-GHz OFDM at rates from 6 to 54 Mbps	
IEEE 802.11b	Physical layer: 2.4-GHz DSSS at 5.5 and 11 Mbps	
IEEE 802.11c	Bridge operation at 802.11 MAC layer	
IEEE 802.11d	Physical layer: Extend operation of 802.11 WLANs to new regulatory domains (countries)	
IEEE 802.11e	MAC: Enhance to improve quality of service and enhance security mechanisms	
IEEE 802.11f	Recommended practices for multivendor access point interoperability	IFFF 802 11
IEEE 802.11g	Physical layer: Extend 802.11b to data rates >20 Mbps	
IEEE 802.11h	Physical/MAC: Enhance IEEE 802.11a to add indoor and outdoor channel selection and to improve spectrum and transmit power management	Standards
IEEE 802.11i	MAC: Enhance security and authentication mechanisms	
IEEE 802.11j	Physical: Enhance IEEE 802.11a to conform to Japanese requirements	
IEEE 802.11k	Radio resource measurement enhancements to provide interface to higher layers for radio and network measurements	
IEEE 802.11m	Maintenance of IEEE 802.11-1999 standard with technical and editorial corrections	
IEEE 802.11n	Physical/MAC: Enhancements to enable higher throughput	
IEEE 802.11p	Physical/MAC: Wireless access in vehicular environments	
IEEE 802.11r	Physical/MAC: Fast roaming (fast BSS transition)	
IEEE 802.11s	Physical/MAC: ESS mesh networking	
IEEE 802.11,2	Recommended practice for the Evaluation of 802.11 wireless performance	/
IEEE 802.11u	Physical/MAC: Interworking with external networks	

IEEE 802.11 Terminology

Access point (AP)	Any entity that has station functionality and provides access to the distribution system via the wireless medium for associated stations
Basic service set (BSS)	A set of stations controlled by a single coordination function
Coordination function	The logical function that determines when a station operating within a BSS is permitted to transmit and may be able to receive PDUs
Distribution system (DS)	A system used to interconnect a set of BSSs and integrated LANs to create an ESS
Extended service set (ESS)	A set of one or more interconnected BSSs and integrated LANs that appear as a single BSS to the LLC layer at any station associated with one of these BSSs
MAC protocol data unit (MPDU)	The unit of data exchanged between two peer MAC entites using the services of the physical layer
MAC service data unit (MSDU)	Information that is delivered as a unit between MAC users
Station 9	Any device that contains an IEEE 802.11 conformant MAC and physical layer



IEEE 802.11 - BSS

- basic service set (BSS) building block
- may be isolated
- may connect to backbone distribution system (DS) through access point (AP)
- BSS generally corresponds to cell
- DS can be switch, wired network, or wireless network
- have independent BSS (IBSS) with no AP











PCF

- Supports time-bounded services.
- Lets stations to have priority access to the wireless medium.
- Polling stations one by one (centralized operation)
- Coordinated by Point Coordinator (PC), typically collocated with the AP.
- PCF has higher priority than the DCF.
- Beacon frame is a management frame that maintains the synchronization of the timers in the stations and delivers protocol related parameters.



































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Control Frames

6 control frame types:

- Power Save-Poll (PS-Poll): sent by any station to the AP; request that the AP transmit a frame that has been buffered for this station while the station was in power-saving mode.
- RTS
- CTS
- ACK
- Contention-free end (CF-End): sent by the PC to announce the end of a contention-free period.
- CF-End + CF-ACK: sent by the PC; combined a CF-End with ACK of the data frame the PC last received.













802	2.11 Phys	sical Laye	er	
	802.11	802.11a	802.11b	802.11g
Available bandwidth	83.5 MHz	300 MHz	83.5 MHz	83.5 MHz
Unlicensed frequency of operation	2.4 - 2.4835 GHz DSSS, FHSS	5.15 - 5.35 GHz OFDM 5.725 - 5.825 GHz OFDM	2.4 - 2.4835 GHz DSSS	2.4 - 2.4835 GHz DSSS, OFDM
Number of non- overlapping channels	3 (indoor/outdoor)	4 indoor 4 (indoor/outdoor) 4 outdoor	3 (indoor/outdoor)	3 (indoor/outdoor)
Data rate per channel	1, 2 Mbps	6, 9, 12, 18, 24, 36, 48, 54 Mbps	1, 2, 5.5, 11 Mbps	1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54 Mbps
Compatibility	802.11	Wi-Fi5	Wi-Fi	Wi-Fi at 11 Mbps and below
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Data Rate (Mbps)	802.11b	802.11a	802.11g
1	90+	-	90+
2	75	-	75
5.5(b)/6(a/g)	60	60+	65
9	-	50	55
11(b)/12(a/g)	50	45	50
18	_	40	50
24	-	30	45
36	-	25	35
48	-	15	25
54	_	10	20

802.11n

- IEEE 802.11n has enhancements in 3 general areas:
 - multiple-input-multiple-output (MIMO) antenna architecture
 - most important enhancement
 - radio transmission scheme
 - increased capacity
 - MAC enhancements
 - most significant change is to aggregate multiple MAC frames into a single block for transmission



