

Data Communication

BLM3051

Furkan ÇAKMAK



Lecture Information Form - Weekly Subjects

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Week 11

Week	Date	Subjects
1	04.10.2021	Introduction to Data Communication Standards Used on Data Communication, Architectural models
2	11.10.2021	OSI Reference Model , Layers and Their Functions
3	18.10.2021	Signaling and Signal Encoding
4	25.10.2021	Parallel and Serial Transmission, Communication Media and Their Technical Specs., Multiplexing (TDM, FDM)
5	01.11.2021	Error Detection and Error Correction Techniques
6	08.11.2021	Data Link Control Techniques, Flow Control
7	15.11.2021	Asynchronous and Synchronous Data Link Protocols (BSC, HDLC)
8	22.11.2021	Ara Sınav
9	29.11.2021	Synchronous and Asynchronous Data Link Protocols
10	06.12.2021	LAN Technologies Continued, IEEE 802.4, 802.5, 802.11
11	13.12.2021	Connectionless and Connection Oriented Services, Switching
12	20.12.2021	Wide Area Networking Technologies (X.25, ISDN, FR, ATM, xDSL.)
13	27.12.2021	Communications Equipment's, TCP/IP Model, Security Issues
14	03.01.2022	Research Presentation 1

IEEE 802.11 - WiFi

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- RF
- Infrared
- Static
- Mobile, Nomadic
 - Roaming
- Carrier
- Non-Line-of-Sight Propagation (NLSP)



IEEE 802.11 - WiFi - Con't

- Continuation of the Ethernet
- CSMA/CD -> CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance)
 - Antenna type: half-duplex
 - Fading
 - The signal decreases inversely with the square of the distance
 - Noise
 - Detecting collisions is almost impossible
- IEEE 802.11 MAC
 - DCF (Distributed Coordination Function)
 - CSMA/CA
 - PCF (Point Coordination Function)
 - Polling

IEEE 802.11 - DCF-Distributed Coordination Function

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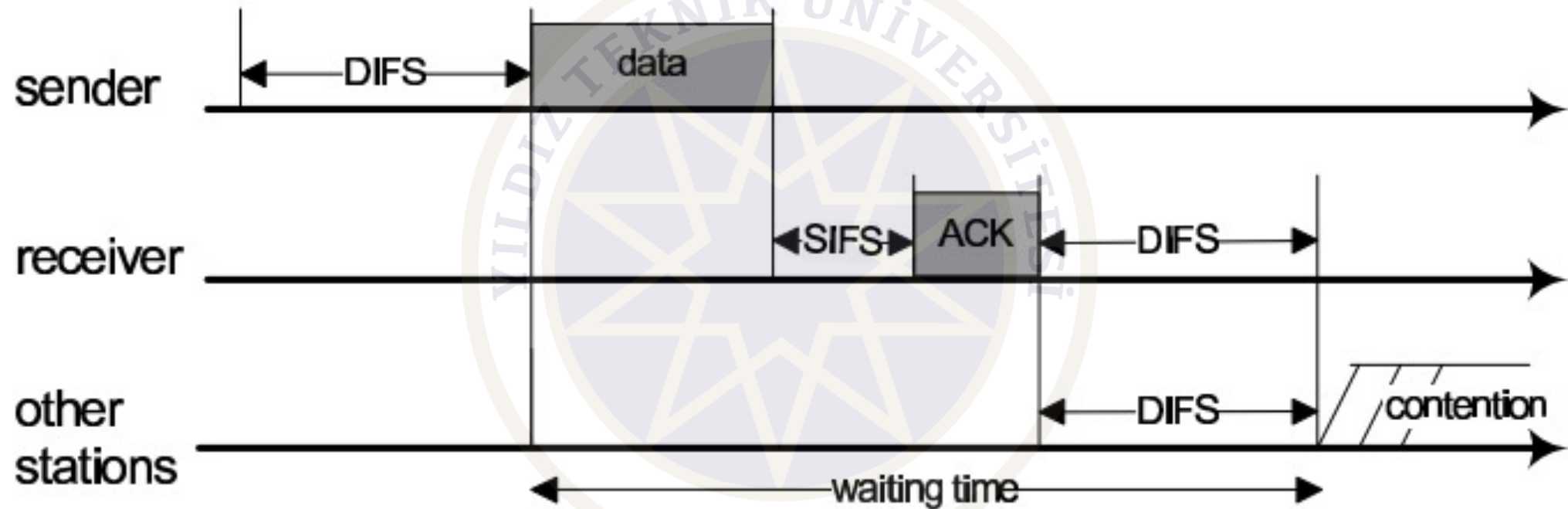
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- DCF basic access method
 - Checks if the line is empty
 - If it sees that the line is empty for DIFS (DCF Inter-Frame Space) time, it switches to transmission.
 - If the line is busy, it delays its own transmission until the transmission is finished.
 - Waits until DIFS (back-off) times is up
 - The back-off timer starts to decrease (DIFS)
 - It transmits when the back-off time value is 0.
 - Timing slots
 - Receiving node sends acknowledgment (ACK) after waiting the time specified by SIFS (Short Inter Frame Space).
 - $SIFS < DIFS$
 - In case a collision;
 - EIFS (Extended Inter Frame Space)

IEEE 802.11 - DCF-Distributed Coordination Function - Con't

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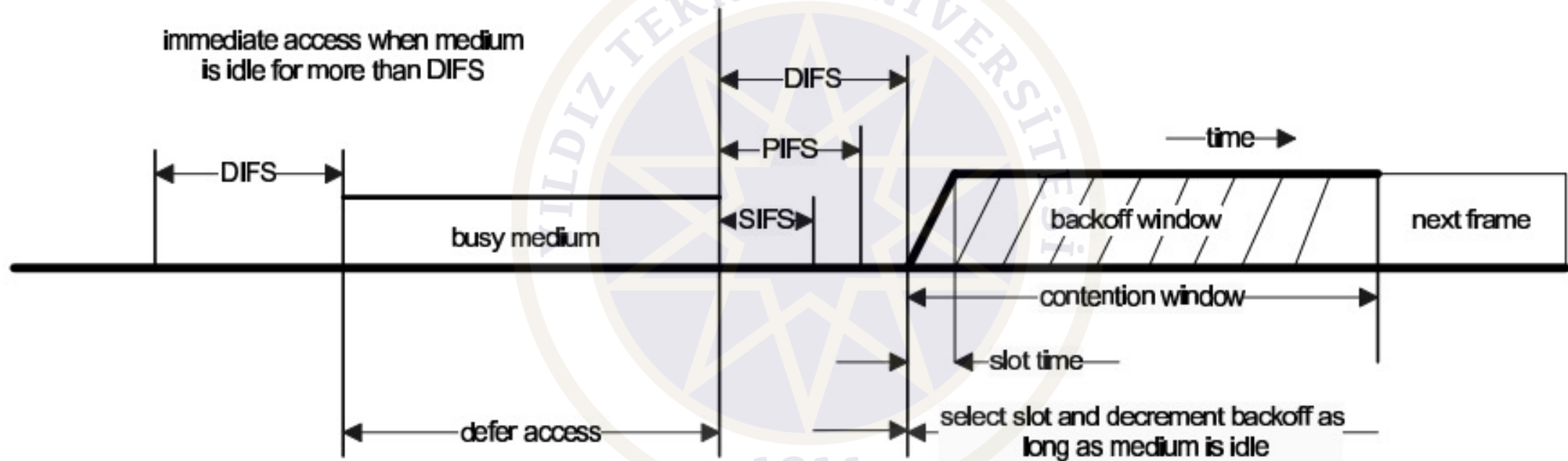
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IEEE 802.11 - DCF-Distributed Coordination Function - Con't

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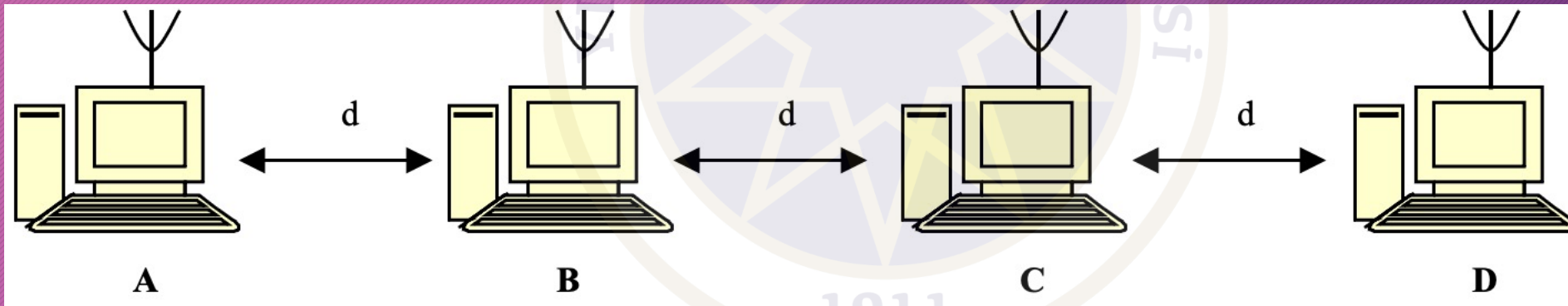
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IEEE 802.11 - DCF-Distributed Coordination Function - Con't

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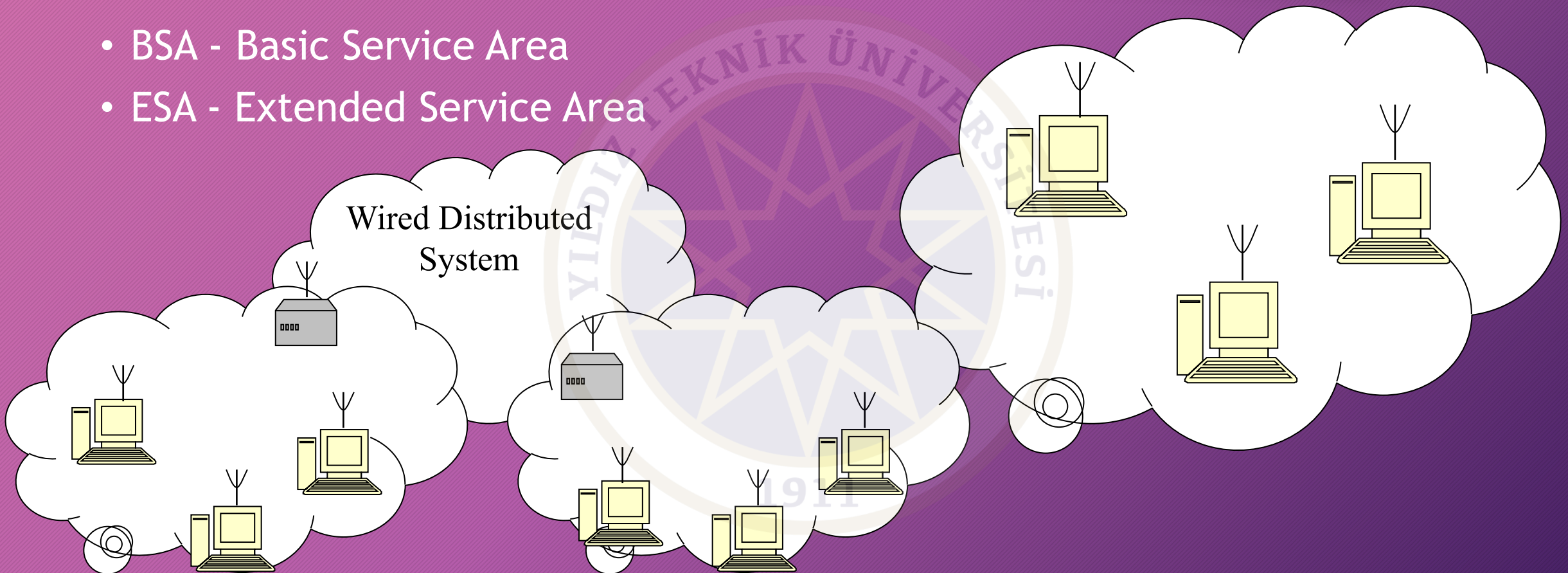
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- RTS (Request To Send) / CTS (Clear To Send)
 - NAV (Network Allocation Vector)
- Hidden Node
- Exposed Node



Service Area

- BSA - Basic Service Area
- ESA - Extended Service Area



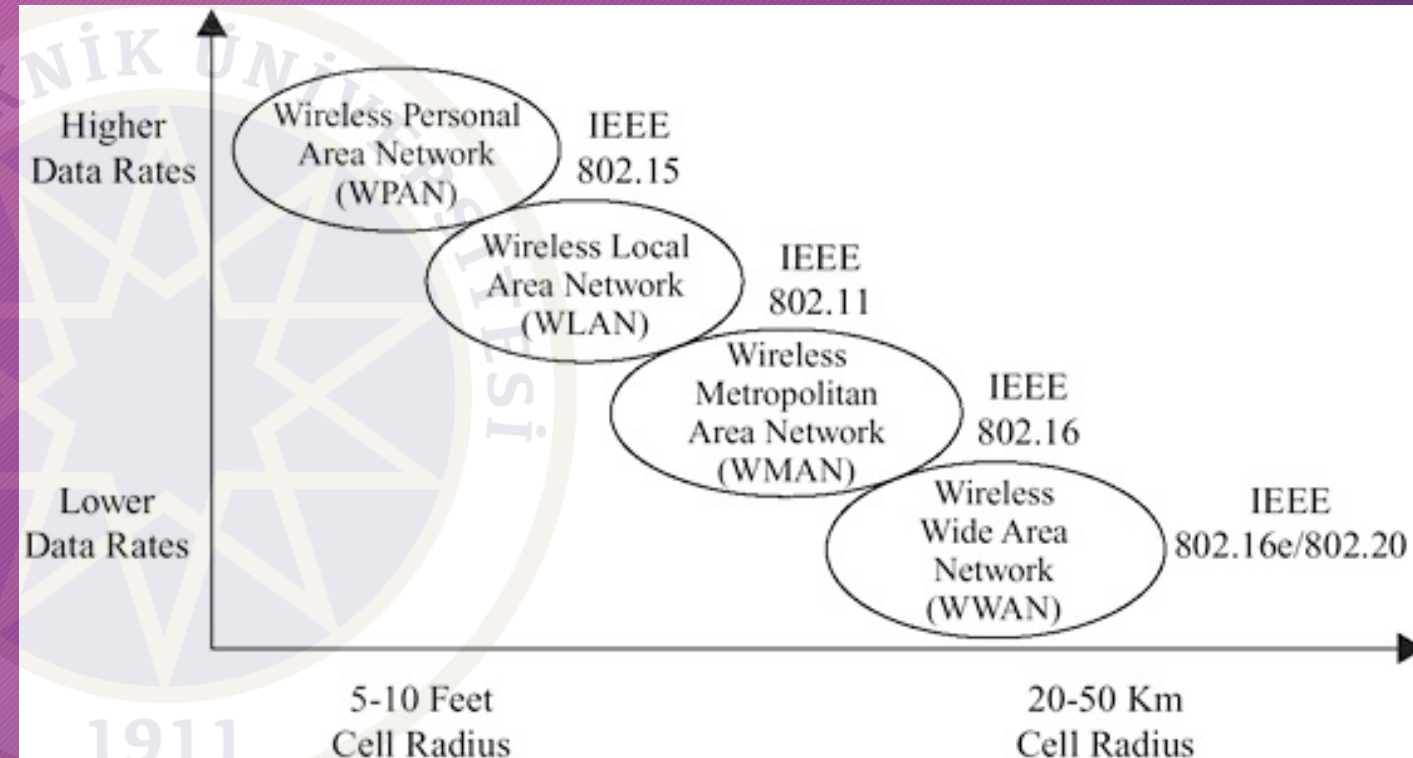
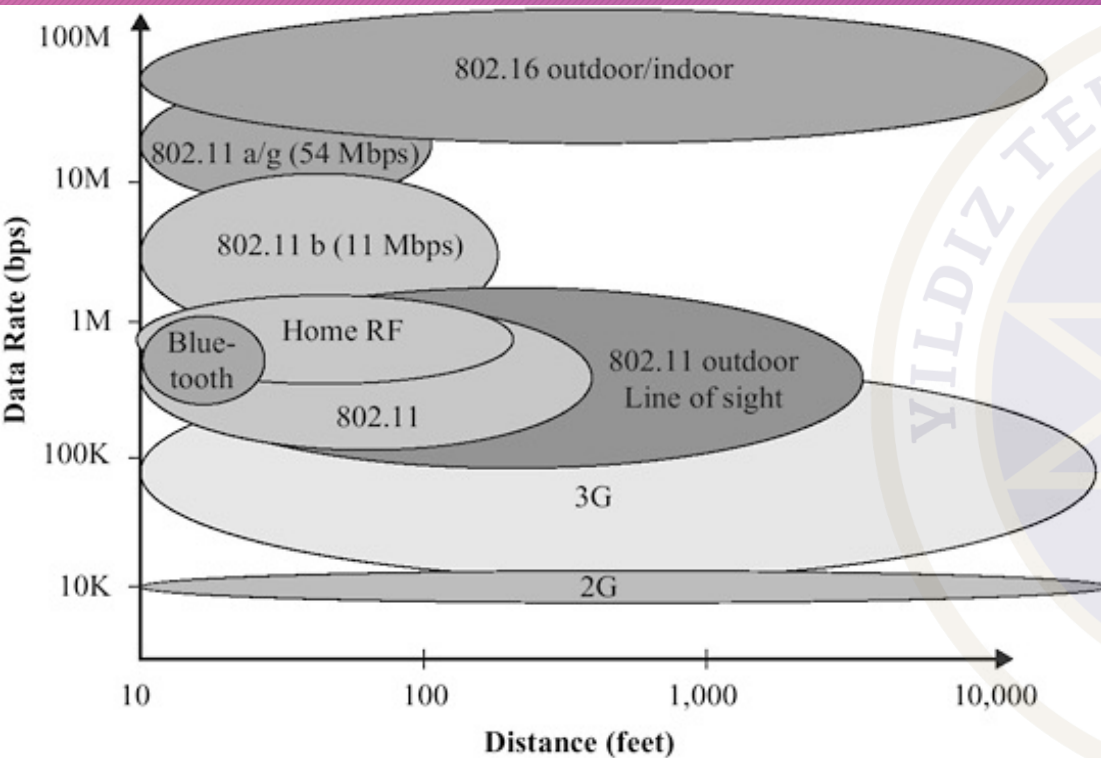
Channel Usage

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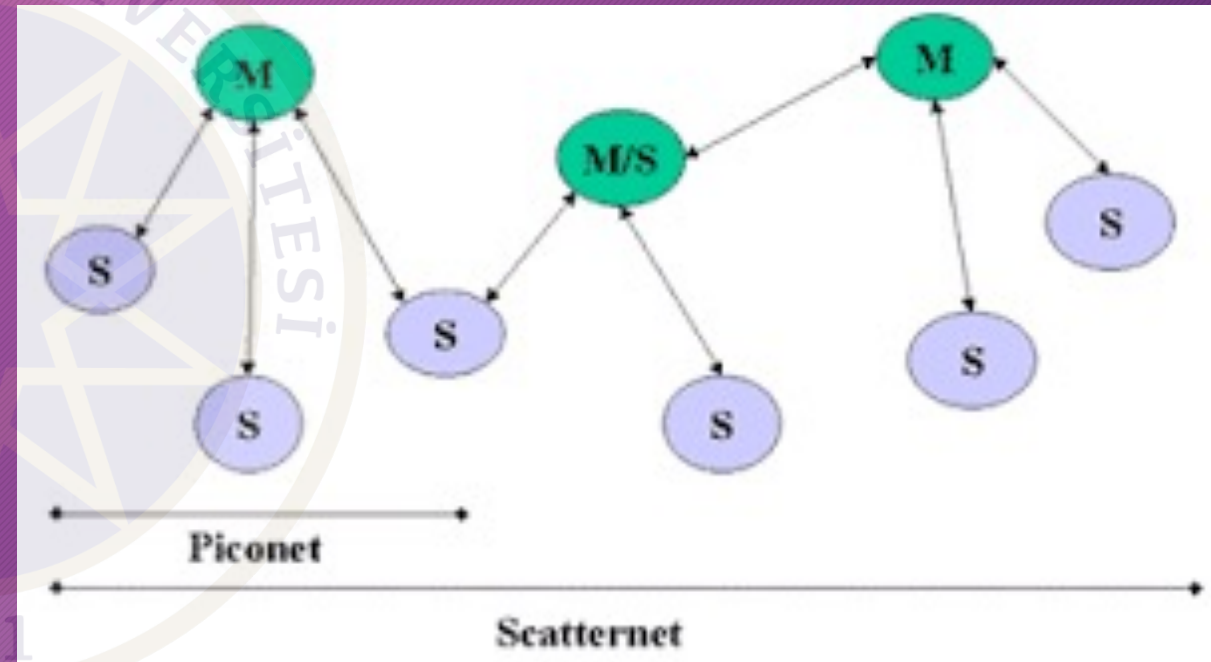
Standart	Bant Geniřlięi	Veri Hızı	Mod�lasyon	�rt�řmeyen Kanal	İ� Ortam	Dıř Ortam
IEEE 802.11	20 MHz	$\leq 2\text{Mbps @ } 2.4\text{GHz}$	FHSS, DSSS		20m	100m
IEEE 802.11a	20 MHz	$\leq 54\text{Mbps @ } 5\text{GHz}$	OFDM	11	35m	120m
IEEE 802.11b	20 MHz	$\leq 11\text{Mbps @ } 2.4\text{GHz}$	DSSS (CCK)	3	35m	140m
IEEE 802.11g	20 MHz	$\leq 54\text{Mbps @ } 2.4\text{GHz}$	OFDM ($>20\text{Mbps}$) DSSS ($<20\text{Mbps}$)	3	38m	140m
IEEE 802.11n	20 MHz 40 MHz	$\leq 72\text{Mbps @ } 2.4\text{GHz}$ $\leq 150\text{Mbps @ } 5\text{GHz}$	OFDM (MIMO – 4 stream)	3/11	70m	250m
IEEE 802.11ac	20 MHz 40 MHz 80 MHz 1600 MHz	$\leq 87.6\text{Mbps @ } 5\text{GHz}$ $\leq 200\text{Mbps @ } 5\text{GHz}$ $\leq 433\text{Mbps @ } 5\text{GHz}$ $\leq 866\text{Mbps @ } 5\text{GHz}$	OFDM (MIMO – 8 stream)			
Bluetooth	Ver 3.0	$\leq 24\text{Mbps @ } 2.4\text{GHz}$	FHSS	79		100m
HomeRF		$\leq 10\text{Mbps @ } 2.4\text{GHz}$	FHSS			
HiperLAN/1		$\leq 20\text{Mbps @ } 5\text{GHz}$	CSMA/CA			
HiperLAN/2		$\leq 54\text{Mbps @ } 5\text{GHz}$	OFDM			

Channel Usage - Con't



Other WiFi Standarts

- **BT (Bluetooth) - IEEE 802.15.1**
 - 1994
 - Ericsson
 - Bluetooth Special Interest Group (SIG)
 - 2.45 GHz (2.402-2.480 GHz)
 - SSFH (Spread-Spectrum Frequency Hopping)
 - 10-100m
 - 24 Mbps
- Piconet
- Scatternet
- Zigbee - IEEE 802.15.4
- HomeRF
- HiperLAN



Threats for Wireless Networks

- Eavesdropping
- Unauthorized Access
 - Intruder
 - Sending message
 - Receiving message
 - Changing message
 - Forging message
 - Compromised
 - Authentication
 - Credential
 - Intrusion detection
- Interference, Jamming
 - Denial of service attack
- Physical threats



Security in Wireless Networks

- Authentication
- Encryption
- Security types
 - Wired Equivalent Privacy (WEP)
 - Encryption only for data, not for header
 - RC4
 - Encryption key is too weak.
 - Wi-Fi Protected Access (WPA)
 - ≥ 2003
 - Temporal Key Integrity Protocol (TKIP)
 - Authentication
 - WPA2 (2010)
 - Advanced Encryption Standard (AES)
 - Extensible Authentication Protocol (EAP)
 - 2008 -> TKIP is unreliable

802.3 Ethernet	+ Yaygın kullanım, sahip olunmuş deneyim + Basit algoritma + Basit kurulum. Yıldız ilingesinde yeni bir bilgisayar eklemek ağıın çalışmasını etkilemez. + Sayısal işaretleşme (Manchester) LSB öncelikli veri iletimi + Düşük yüklerde gecikme sifıra yakındır
	– CD donanımı örneksel – Yüklü çalışma durumunda veri bozulması (collision) olasılığı artar – Non deterministic (Gerçek zamanlı uygulamalar için ideal değil) – Öncelik mekanizması mevcut değil – En az 64’byte’lik çerçeveler – Sınırlı çerçeve büyüklüğü
802.4 Token Bus	+ Deterministic + Öncelik mekanizması (garanti edilmiş bant genişliği) + Yüklü çalışmada mükemmel sonuç + Birden fazla kanal üzerinden iletim imkânı (örneksel)
	– Örneksel yapı (modem, amplifier vs.) – Son derece karmaşık protokol yapısı – Düşük yüklerde gecikmeler artıyor – Fiber kullanımına müsait değil
802.5 Token Ring	+ Sayısal işaretleşme (Differential Manchester) MSB öncelikli veri transferi + Öncelik mekanizması ve 8 seviye + Rezervasyon imkânı + Yüklü çalışmada yüksek verim + İletim ortamındaki çeşitlilik + Kısa ve uzun çerçeve yapıları kullanabilir. + Deterministic
	– Monitör fonksiyonu – Düşük yüklerde jeton iletiminde yaşanan gecikmeler
FDDI	+ Zamana duyarlı veri iletimine öncelik verilmiştir. + Çift halka kullanımı dolayısıyla çalışma süreklilik vardır. + Fiber kullanımı ile kapsadığı mesafe arttırılmıştır
	– Hız olarak ihtiyaçların gerisinde kalmak üzeredir.
WLAN	+ Mobil olma kavramını getirmiştir + Fiziksel olarak kablo çekmenin mümkün olmadığı yerlerde son derece tatminkâr sonuçlar üretir.
	– Sınırlı mesafe içinde çalışmaktadır. – Kablolu ağlara nazaran iletişim hızları düşüktür.

Thank you for your listening.

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