Different types of WiFi Protocols

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By Bilal Boumahdi, Kyle Hansen, Trisha Blair, Luke Dunk, Omarion Branch

WiFi protocol types

802.11a (1999)
802.11b (1999)
802.11g (2003)
802.11n (2009)
802.11ac(2014,16)

On the right, are just some of the different wifi protocol types. These protocols have ranged from 1999 all the way to the present. These protocols were properly utilized in order to enable for better internet usage and better access to the World Wide Web.

802.11a (1999)

802.11a was released in 1999 and had very mediocre performance for today's standards having varying modulation types that went from 6 Mbps up to 54 Mbps. It utilized orthogonal frequency-division multiplexing, also known as (OFDM), with “52 subcarrier channels.” This paired with the “12 non-overlapping channels” allowed for a 5GHz frequency band.

802.11b (1999)

- IEEE expanded on the original 802.11 standard in july 1999, creating the 802.11b specification

- 802.11b supports a theoretical speed up to 11 Mbps. A more realistic bandwidth of 2 Mbps (TCP) and 3 Mbps (UDP) should be expected.

- 802.11b uses the same unregulated radio signaling frequency (2.4 GHz) as the original 802.11 standard. Vendors often prefer using these frequencies to lower their production costs. Being unregulated, 802.11b gear can incur interference from microwave ovens, cordless phones, and other appliances using the same 2.4 GHz range. However, by installing 802.11b gear a reasonable distance from other appliances, interference can easily be avoided

Omar Branch, Source:
https://www.lifewire.com/wireless-standards-802-11a-802-11b-g-n-and-802-11ac-816553#toc-80211b

802.11b (1999)

Advantages

- 802.11b is widely supported by manufactures, and very cost effective
- Easy to set-up and maintain
- More suitable for a home environment

Disadvantages

- Supports only up to 11 Mbps bandwidth. (enough for most application, limits number of users allowed on it)
- It operates in 2.4GHz frequency band, which is normally used by many appliances. Hence, it is more interference prone compared to 802.11a
- Doesn't provide suitable scalability required in business environment.

Omar Branch, Source: https://www.anandsoft.com/networking/802.11b.html#:~:text=Supports%20only%20up%20to%2011Mbps,prone%20compared%20to%20802.11a.

802.11g

- This protocol is directly associated with Wi-Fi 3 and significantly boosts previous speeds up to 54Mbps
- Advantage: Backwards compatibility towards the previous generation 802.11b, as they both operate on 2.4 GHz frequency. All devices can benefit from faster speeds
- Disadvantage: Costs more to implement than its previous protocol and home appliances could interfere with the microwaves frequency.

Year Adopted	2003-2009
Frequency	2.4 GHz
Max Data Rate	54 Mbps
Typical Range Indoors	125 ft
Typical Range Outdoors	450 ft

Luke Dunk

802.11n (2009)

- IEEE (Institute of Electrical & Electronics Engineers) standard for wireless networking that boosts **speed**, **dependability**, and **range** of wireless transmissions in **WLANs**
- Key features: MIMO technology, frame aggregation
- An update to 802.11g (54 Mbps). Addressed need for throughput brought on by the increase of **Wi-Fi-enabled** devices.
- Still the **most popular** Wi-Fi standard in use today due to numerous low-end devices

Trisha Blair

Year adopted	2009
Frequency	2.4 / 5 GHz
Max Data Rate	600 Mbps
Typical Range Indoors	225 ft
Typical Range Outdoors	825 ft

802.11ac (2014,2016)

802.11ac – Gigabit Wi-Fi

- 802.11ac is an extension of 802.11a this standard operates in the 5GHz spectrum, and is being replaced by “Wi-Fi 6“ 802.11ax
- Compared to previous standards .11ac is it has higher top end value and contributions
- Channels up to 80 MHz wide
- Theoretical maximum speed of 1300Mbs compared to 450Mbs of 802.11n

Kyle Hansen

802.11ac benefits and Limitations

Benefits of 802.11ac

- Faster data rates
- Higher per cell overall capacity
- Increased bandwidth for multiple devices
- Resilient against interference when beamforming is used

Limitations of 802.11ac

- Released in two waves, so keeping track of what devices used which wave was difficult
- Already replaced by Wi-Fi 6 802.11ax

Kyle Hansen

802.11 Wireless Standards

IEEE Standard	802.11a	802.11b	802.11g	802.11n	802.11ac
Year Adopted	1999	1999	2003	2009	2014
Frequency	5 GHz	2.4 GHz	2.4 GHz	2.4/5 GHz	5 GHz
Max. Data Rate	54 Mbps	11 Mbps	54 Mbps	600 Mbps	1 Gbps
Typical Range Indoors*	100 ft.	100 ft.	125 ft.	225 ft.	90 ft.
Typical Range Outdoors*	400 ft.	450 ft.	450 ft.	825 ft.	1,000 ft.

References

Different wi-fi protocols and data rates. Intel. (n.d.). Retrieved April 4, 2023, from https://www.intel.com/content/www/us/en/support/articles/000005725/wireless/legacy-intel-wireless-products.html

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Bilal Boumahdi pages contributed : slides (2 and 3)

Omar branch (slides 4&5)