

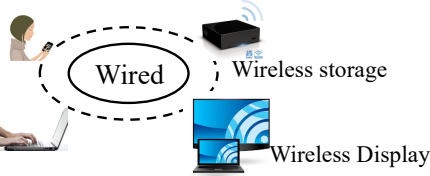
Trends in Mobile Data Networking

Wireless/Mobile History 1880 - 2020

- 1880: Hertz discovered electromagnetic waves
- 1898: First commercial radio data service
- 1921: First Mobile Radio: Wireless dispatch system for Detroit Police
- 1946: First Mobile Telephone Service: Push to talk.
- 1970: First Cellular Phone Service
- 1971: First Wireless Data Network
- 1990: First Commercial WLAN Product 1997: First WLAN Standard - IEEE 802.11 2Mbps
- 2020: WLAN 5/6, Bluetooth 5.0, 5G

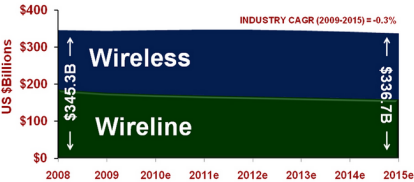
Access is all wireless

- Wireless, in the form of WiFi, started in 1999.
 - First it was an option.
 - Now it is standard in all computing devices
- Most of the access (end user connectivity) is wireless
- Mobile phones, tablets have multiple wireless technologies: WiFi, Bluetooth, Cellular, but *no wired connectivity*



Most Revenue in Wireless

- US Wireless industry is valued at \$195.5 billion \geq publishing, agriculture, hotels and lodging, air transportation, and motion picture and recording.
- Wireless industry directly/indirectly provides more than 2.6% of all US employment
- Wireless revenue is expanding



Ref: <http://www.ctia.org/your-wireless-life/how-wireless-works/wireless-quick-facts>
http://atlantic-acm.com/index.php?option=com_content&view=article&id=557%3Avisual-dataline-us-telecom-wireless-and-wireline-service-revenues-2010-2015&catid=46%3A2010-datalines&Itemid=20

Mobile speed forecast

CISCO annual report 2018-2023

- Wi-Fi speed will triple by 2023.** Globally, the average Wi-Fi speeds will grow from 30.3 Mbps in 2018 to 92 Mbps by 2023.
- Cellular speeds will more than triple by 2023.** The average mobile network connection speed was 13.2 Mbps in 2018 and will be 43.9 Mbps by 2023.
- The average 5G connection speed will reach 575 Mbps by 2023.

The incredible momentum of WiFi

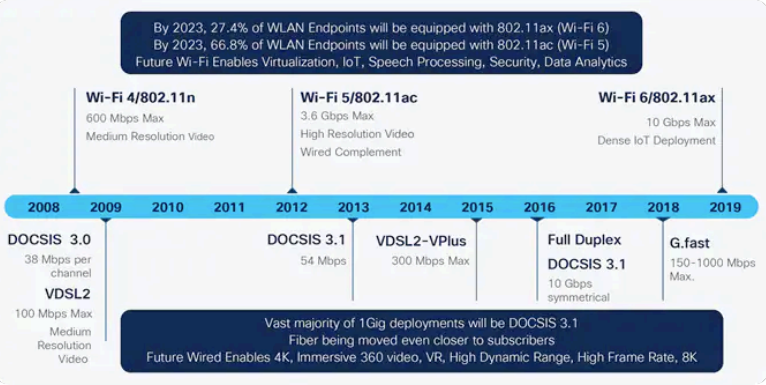
CISCO report



- Wi-Fi hotspots will grow four-fold from 2018 to 2023.** Globally, there will be nearly 628 million public Wi-Fi hotspots by 2023, up from 169 million hotspots in 2018.
- Wi-Fi6 hotspots will grow 13-fold from 2020 to 2023** and will be 11 percent of all public Wi-Fi hotspots by 2023.

WiFi evolution

CISCO Annual Report 2018-2023



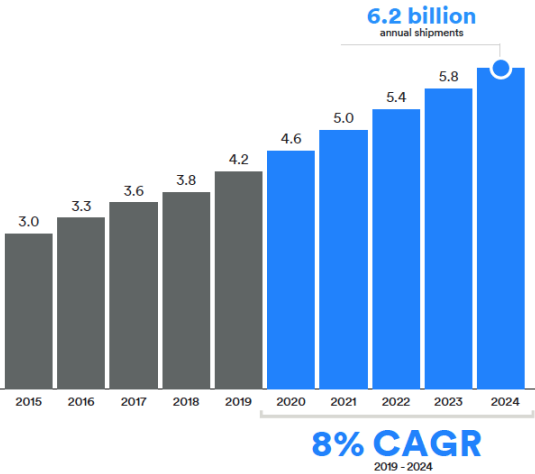
Mobile growth forecast

CISCO annual report 2018-2023



Total Annual Bluetooth® Device Shipments

numbers in billions



Bluetooth revolution