The Evolution of Wireless

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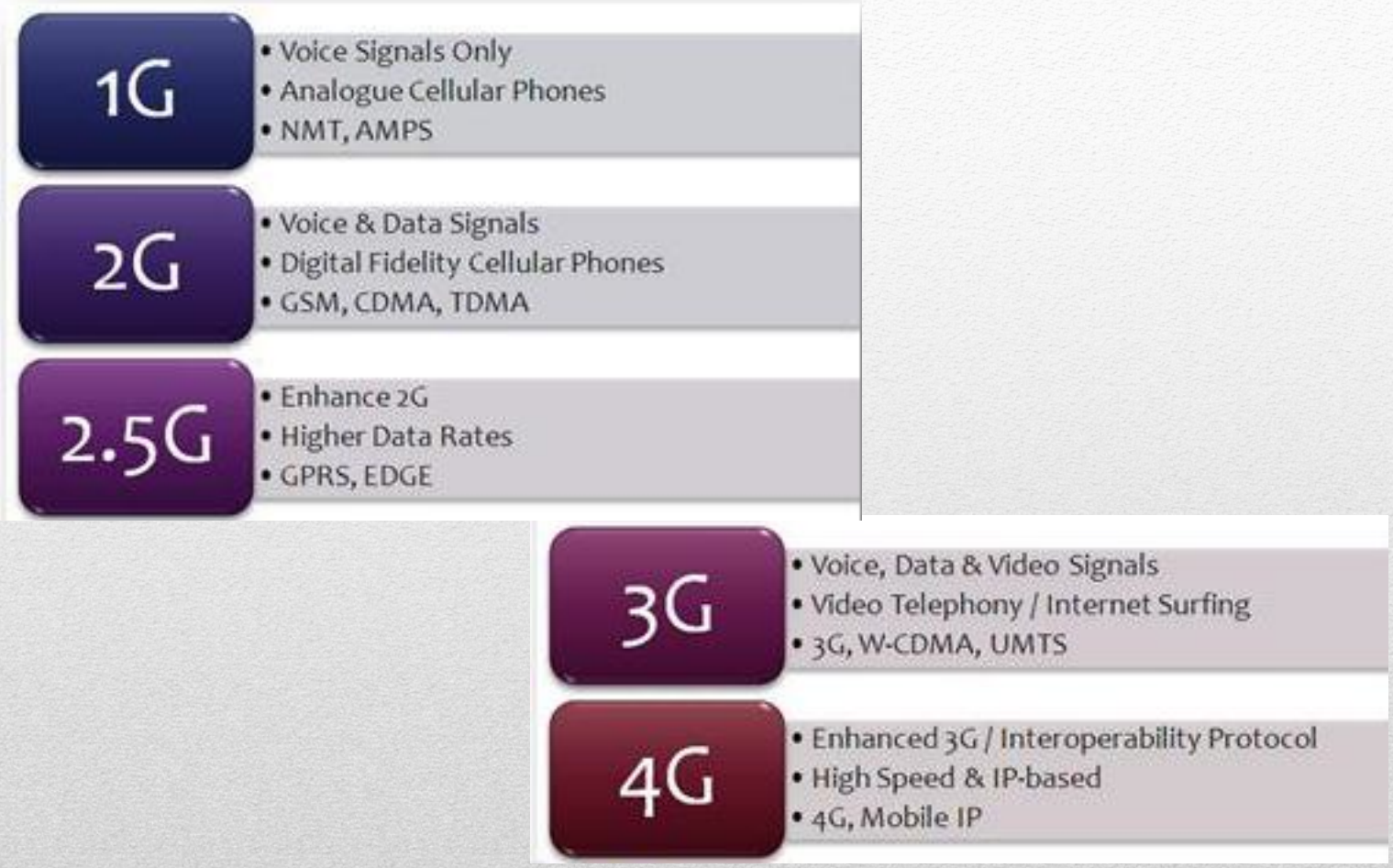
Mobile Devices

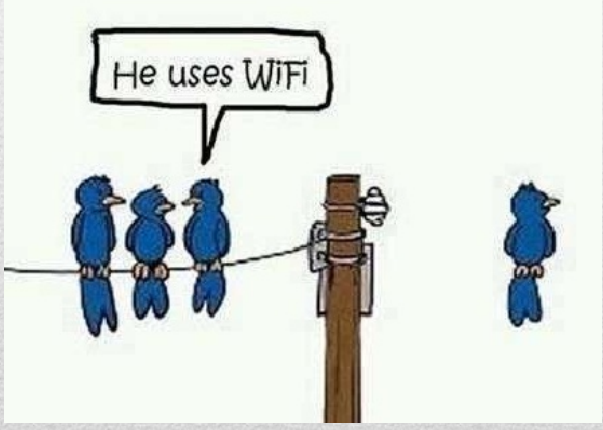


Mobile Networks

Difference from WiFi

- Mobile networks are built on a specific frequency band bought from the government
  - Same thing that radio and TV stations run on

- WiFi is considered a “free” frequency that anyone can use in **very** close range



Shannon's Limit

- Mobile carriers have their own distinct frequency band range that they purchased from the FCC
- Number of spectrums owned specifies how good of a coverage you get
- Each frequency support a certain bit rate

$$C = B \log_2 \left(1 + \frac{S}{N}\right)$$

Timeline

- 1G: 1979 – 1990 (Analog)
- 2G: 1990 – 2001 (Digital)
  - 2.5G (Bridge to 3G)
- 3G: 2001 – Present (Broadband)
- 4G: 2010 – Present (LTE)

1G – Analog

- AMPS (Advanced Mobile Phone System) Network
  - Voice-Only networking operating on the 800MHz band
- NMT (Nordic Mobile Telephone) was the first fully automatic cellular phone system
- Permanently shut down in 1999, anyone with a radio scanner could listen to your call and susceptible to noise
- Had ~ 2 million subscribers at its peak

2G – Digital

- Fixes to network congestion and security from 1G
- GSM (Global System for Mobile)
  - Radio frequency band ranging from 900MHz to 1800MHz
- Initially TDMA (Time Division Multiple Access)
  - Synchronized static timeslot allocation
- Later used CDMA (Code Division Multiple Access)
  - Orthogonal signals sent by all customers
- SMS (Short Message Service), AKA text messages ☺

2.5G – Bridge to 3G

- Unofficial stepping stone term for 2G with elements of 3G enhancing its performance
- EDGE (Enhanced Data rates for GSM Evolution)
  - Increased rate of 2G network resulting in faster speeds
- GPRS (General Packet Radio Service)
  - Packet oriented mobile data service
- Digital encryption and caller ID added as well

3G – Broadband

- UMTS (Universal Mobile Telecommunications System)
  - Core network architecture on 2100mHz spectrum
- WCDMA (Wideband CDMA)
  - Significant algorithm and mathematical improvements in signal transmission, allowing more efficient transmissions
- Interactive gaming, TV services, and internet streaming

4G – Long Term Evolution

- Enhanced 3G through a series of upgrades to UMTS
  - significantly faster speeds (~ 10 times faster than 3G)
  - lower latency
  - reduced network congestion
- EPC (Evolved Packet Core) IP-based architecture
  - Simpler architecture results in lower operating costs
  - Backwards compatible with 3G technologies

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