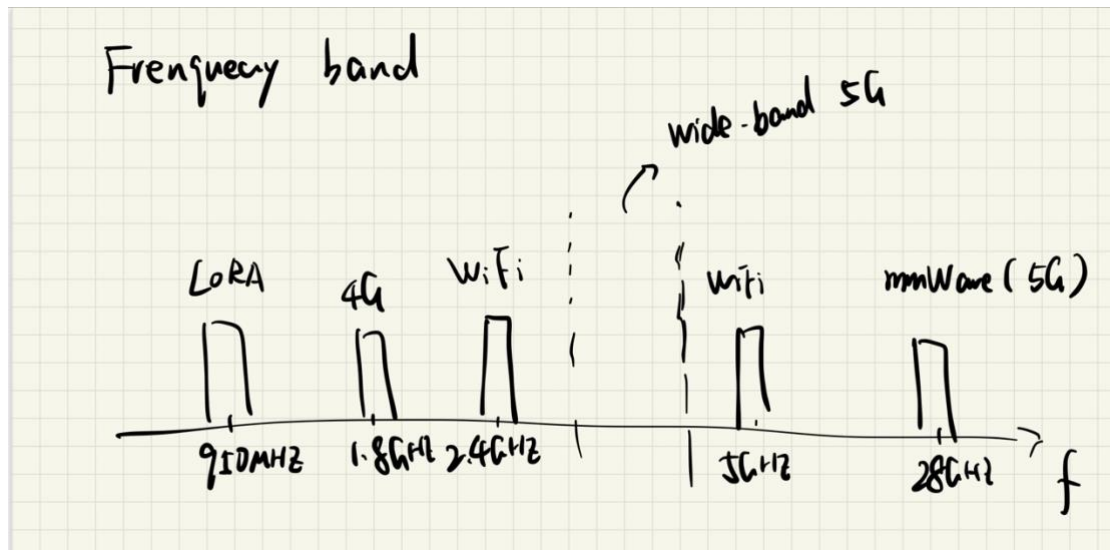


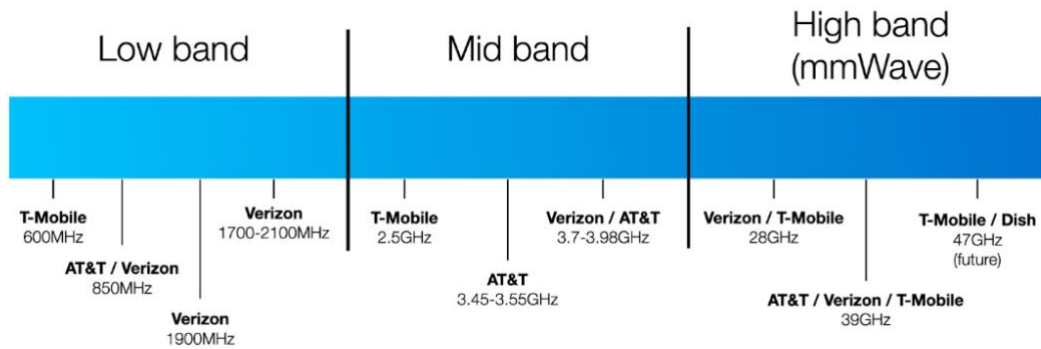
Lecture #19 note

Some basic concepts for 5G

- Licensed and unlicensed spectrum: the spectrum of cellular or 5G is licensed and users must pay for it. The spectrum of WiFi or Bluetooth is unlicensed and free.
- Frequency band



5G frequency band



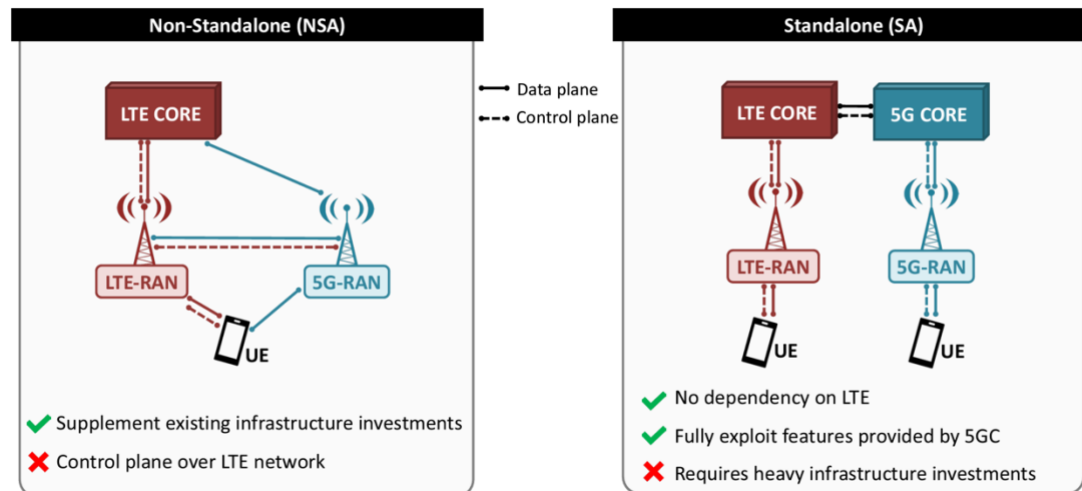
(<https://5gstore.com/blog/2022/07/13/what-frequency-bands-does-5g-use/>)

c) Radio-access network (RAN), Core, Standalone (SA) and Non-standalone (NSA)

SA: 5G RAN+5G core, NSA: 5G RAN + 4G Core

The packet goes from UE to BS and to the core. At core, billing, authentication, routing, and fire wall are conducted.

Core can be in BS, cloud, or edge.



(https://courses.engr.illinois.edu/ece598hh/fa2020/Lectures/ECE598HH_FA20_Lec16.pdf)

5G standard

1. 5G VS LTE

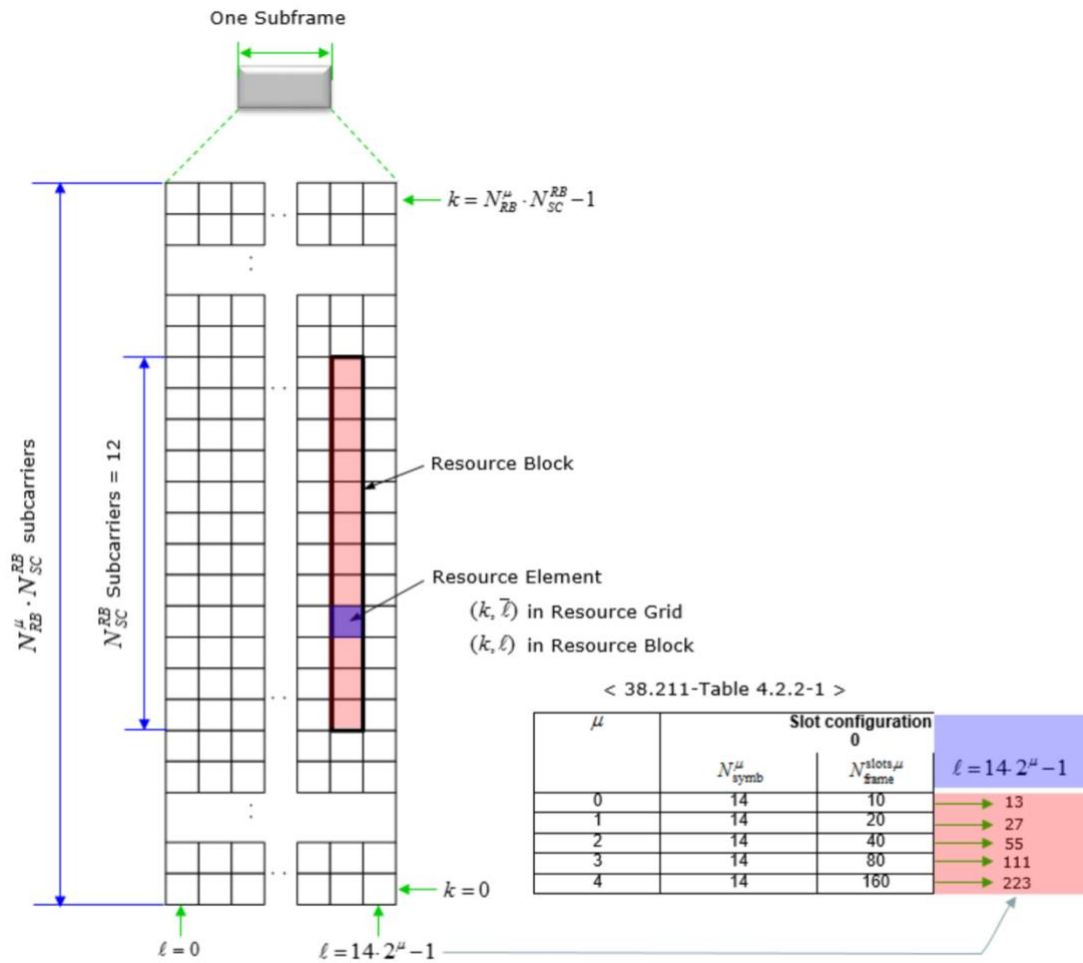
- Higher center band and bandwidth
- Variable subcarrier spacing (**provides flexibility to support different services which have different latency requirements**)
- Flexible bandwidth allocation

2. Slots, OFDM symbols, Resource block

- Frame (10ms) sent between BS and device, one frame consists of 10 subframe (1ms)
- Resource element (RE): one subcarrier and one OFDM symbol
- Resource block contains 12 subcarriers

3. 5G signal decoding process

- Synchronization for signal and get the control information (CORESET + PDCCH), then decode data (PDSCH)
- Beam sweeping: **provides a new dimension (spatial dimension) for interference-free**



Resource Element : This is same as LTE. It is the smallest unit of the resource grid made up of one subcarrier in frequency domain and one OFDM symbol in time domain.

Resource Block: In NR, Resource Block is defined only for frequency domain. 38.211-4.4.4.1 states '*A resource block is defined as $12(N_{RB_sc})$ consecutive subcarriers in the frequency domain*'. Time domain definition of resource block is a little bit ambiguous. Minimum time domain length in a resource block can be one OFDM symbol, but exact time domain length vary depending [SLIV](#).

(ShareTech, https://www.sharetechnote.com/html/5G/5G_ResourceGrid.html)