

DES535

Ubiquitous Computing

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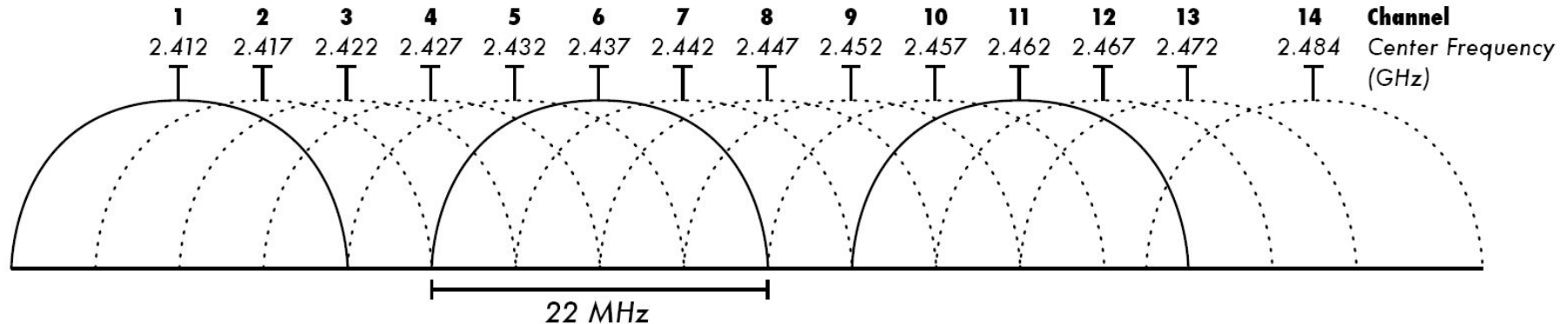
Google Classroom Code : pcwnf5t

Motion & Activity Sensing

Module V (Part II)

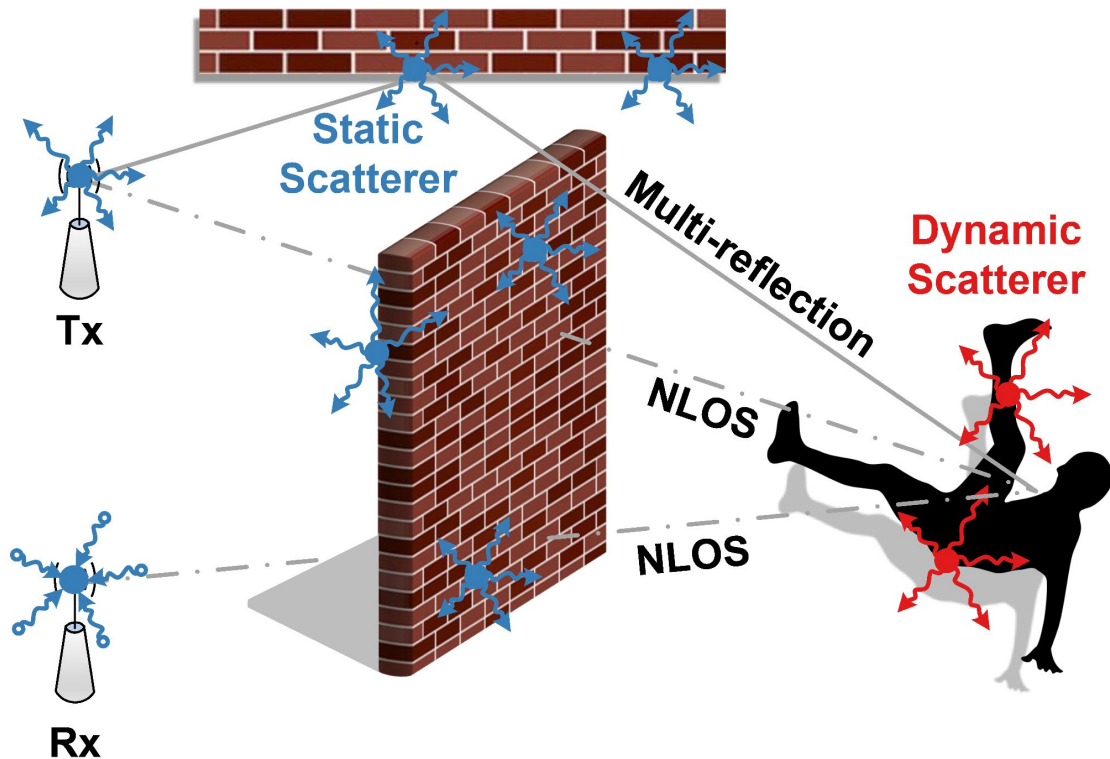
WiFi Sensing : Channels

- Exchange data by radio waves.
- Wi-Fi most commonly uses the 2.4 gigahertz and 5 gigahertz radio bands.
- The frequency band is divided into multiple channels.
- According to the electromagnetism theory, the radio signals emitted by the transmitter (Tx) experience various physical phenomena such as reflection, diffraction, and scattering during the propagation process and form into multiple propagation paths.



WiFi Sensing : Scattering

Therefore, the received superimposed signals carry the physical information of the signal propagation space.

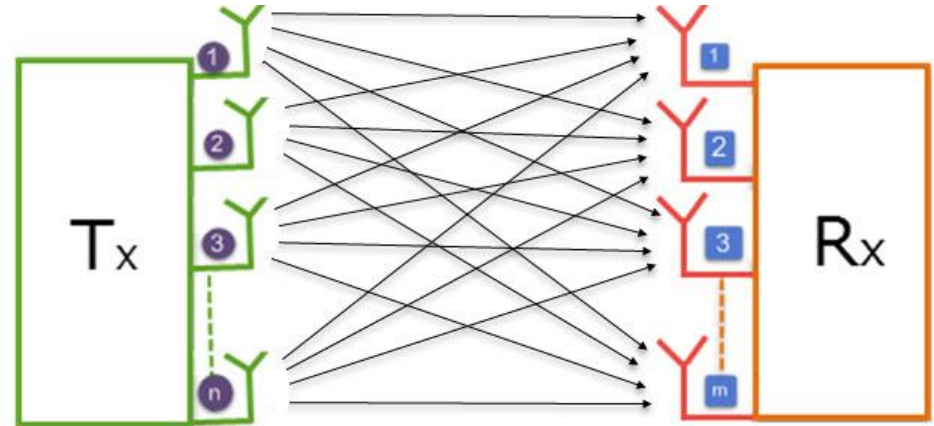


WiFi Sensing : Channel State Information (CSI)

- CSI describes the propagation process of the wireless signal and therefore contains geometric information of the propagation space.
- The CSI makes it possible to adapt transmissions to current channel conditions, which is crucial for achieving reliable communication with high data rates in multiantenna systems.
- The CSI observed by the receiver is added up with the portions contributed by the static (furniture, walls, etc.) and dynamic (arms, legs, etc.) scatterers.
 - Each scatter is deemed as a virtual Tx.
 - Such modeling can be applied to typical indoor scenarios, where the rooms are crowded with furniture, and signals could propagate in almost all directions.

WiFi Sensing : Background

- Multiple Input Multiple Output (MIMO)
 - Employs **multiple antennas** at both the transmitter and receiver to send and receive multiple data streams.
 - Significantly boosts wireless data speeds.
 - Increases reliability by transmitting data through multiple paths, allowing the system to overcome interference or signal fading.
 - MIMO uses spatial multiplexing, which splits the data into smaller streams that are sent simultaneously over different antennas.
 - Optimizes the use of available bandwidth.



WiFi Sensing : Background

- Orthogonal Frequency Division Multiplexing (OFDM)

