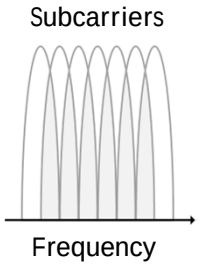
4G & 5G Mobile Technology

LTE Components

LTE Components

❖ **OFDM (Orthogonal Frequency Division Multiplexing)**

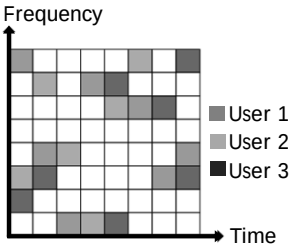


- Carry data using closely spaced orthogonal subcarrier signals
- OFDM is resilient against severe channel conditions such as narrowband interference and frequency selective fading
- Provides high spectral efficiency and simple channel equalization

LTE Components

❖ OFDMA (Orthogonal Frequency Division Multiple Access)

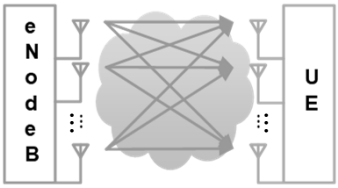
- Assign subsets of subcarriers to multiple users
- OFDMA enables adaptive carrier allocation, high spectral efficiency, and little interference between subcarriers



LTE Components

❖ MIMO & Precoding

- MIMO enables reliable operation, large spectral efficiency, and increased data rate by utilizing multipath signal propagation based on multiple antennas at the transmitter and receiver
- Precoding is used to map the modulation symbols to different antennas

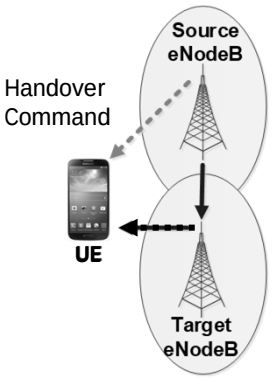


MIMO: Multiple **Input Multiple Output**

LTE Components

❖ Handover & Packet Forwarding

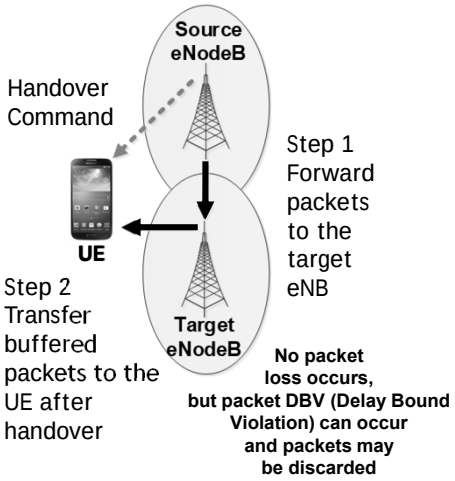
- Source eNB decides HO (handover) by sending a Handover Command message based on the HO conditions
  1. Source eNB's signal is below a threshold level
  2. Target eNB's signal is stronger
  3. etc.



LTE Components

❖ Handover & Packet Forwarding

- During handover, data loss is prevented by the packet forwarding process that buffers and transfers undelivered data packets to the UE



LTE Components

❖ **MBMS (Multimedia Broadcast Multicast Service)**

- MBMS utilizes the efficient point-to-multipoint distribution feature of LTE for broadcast
- Many MBMS services are influenced by packet DBVs (Delay Bound Violations)
- Video Broadcast Example
  - 20 fps (frames per second) Video stream
  - Each packet must be used in frame reconstruction within the 50 ms frame period

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References

References

- 3GPP TS 36.211 v12.5.0, “Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation,” Mar. 2015.
- 3GPP TS 36.212 v12.4.0, “Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding,” Mar. 2015.
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