Mobile Communications
Problem Set 9

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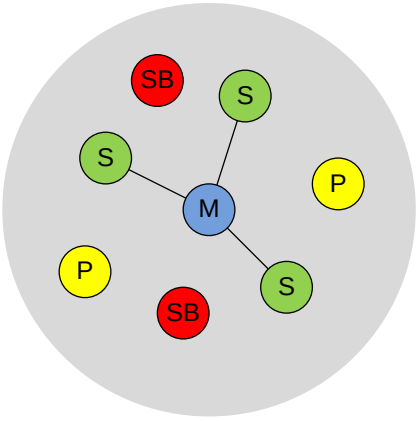
1. What is a piconet? and how is it characterized? Explain the two roles that Bluetooth devices can play in a piconet. What is the implication of the length of the active member address range (3 bit) and the passive member address range (8 bit)?

   Solution:



   - A piconet is a collection of connected Bluetooth devices
   - A piconet is characterized by a pseudo random hopping sequence
   - Devices can be master or slave
     - Master determines the hopping sequence
     - Slaves have to synchronize to the hopping sequence
   - AMA (3 bit) -> max 7 slaves
   - PMA (8 bit) -> 256 parked devices

2. Can Bluetooth interfere with 802.11 (WLAN)? Is it possible for two piconets to interfere with each other?

   Solution:

   Bluetooth operates in the 2.4 GHz ISM band such that it interferes (theoretically) with 802.11 which operates in the same band. However, the interference is quite small as

   - Bluetooth channels are 1 MHz wide (compares to 20 or 40 MHz of 802.11) (1 OFDM subcarrier is 312.5 kHz wide)
   - the typical transmit power of Bluetooth (commonly found in mobile devices) is 2.5 mW (class 2) compared to 100 mW of WLAN in Germany (up to 1 W in the US)

Piconets are separated by FH-CDMA, i.e., each piconet has a unique hopping sequence. However, interference can still occur when devices that belong to different piconets transmit at the same time on the same frequency. Remember, Bluetooth does not use carrier sense and the hopping sequences of several piconets may overlap. Usually only a small number of slots are affected and a fast retransmit mechanism (ARQ) is used. Note that at the time of the retransmission stations have hopped again.