Mobile Communications
Problem Set 1

Prof. Dr.-Ing. Markus Fidler
M.Sc. Felix Langenbruch

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1 General Questions

1. Networks may be classified by the spacial dimension of communications. Name four classes of networks that are distinguished by the spacial dimension (including an example).
2. Name and explain the layers of the OSI model that are discussed in the lecture.
3. How is the wave length of electromagnetic waves in free space related to its frequency?

Solution:

1. Networks may be classified by the spacial dimension of communications into
   (a) Personal Area Network (PAN), Bluetooth
   (b) Local Area Network (LAN), WLAN
   (c) Metropolitan Area Network (MAN), WiMAX
   (d) Wide Area Network (WAN), GSM, UMTS, LTE
2. Reference model (OSI):
   (a) Application layer: support of different applications and their requirements in wireless and mobile communications
   (b) Transport layer: establish and maintain an end-to-end connection with flow and congestion control and a certain quality of service
   (c) Network layer: connection establishment, routing of packets over a number of intermediate systems involving addressing, device location, handover between networks or base stations
   (d) Data link layer: medium access and multiplexing of data streams, frame synchronization, correction of transmission errors to establish reliable point-to-(multi)point connections
   (e) Physical layer: conversion of bit streams into signals that are transmitted, involves channel coding, frequency selection, modulation, and signal detection at the receiver
3. For electromagnetic waves the following relation holds for free space:
   $$\lambda \cdot f = c$$
   where c denotes the speed of light, that is $3 \cdot 10^8$ m/s.