S-72.3240 Wireless Personal, Local, Metropolitan, and Wide Area Networks

Exam 3.9.2007

1. *Indicate whether the following statements are TRUE or FALSE (for each statement, correct answer: 1p, wrong answer: -1p, no answer: 0p) on your exam paper:*

   a) In Bluetooth, the signal hops among 79 frequencies spaced 1 MHz apart.
   b) The ISM frequency band at 2.4 GHz is a licensed frequency band.
   c) In a WLAN, the RTS/CTS scheme is used to avoid the hidden node problem.
   d) IEEE 802.15.4 (ZigBee) systems are based on CSMA/CA access technology.
   e) Inter-access point protocol (IAPP) offers mobility in the OSI application layer.
   f) "Voice over RTP over TCP over IP" is typically used as a VoIP protocol stack.
   g) In a WLAN, SSID means "alphanumeric network name".
   h) The IEEE 802.16 (WiMAX) uplink subframe contains a contention slot for initial ranging.
   i) The WiMAX uplink subframe contains a contention slot for authentication purposes.
   j) The acronym UMA means Unlicensed Mobile Access.

2. *Please list the missing words or expressions on your exam paper:*
   In wireless medium access, (a) _____ **carrier sensing** is based on using a (b) **network** _____ **vector**. The main four security requirements of a secure system are the following: (c) _____ , (d) _____ , (e) _____ , and (f) _____ . An IPv4 address consists of (g) _____ number of bytes, whereas a MAC address consists of (h) _____ number of bytes.
   IEEE 802.16 (WiMAX) systems offer the following mechanisms for dynamically managing QoS and bandwidth: In the PHY layer (h) __ __ __ __ , in the MAC layer (i) __ __ __ __ , and at higher protocol layers (j) __ __ __ __ . (Use several words for describing these mechanisms.)

3. *Explain the differences between the medium access methods CSMA/CA and CSMA/CD. In which kind of networks are these medium access methods used?*

4. *Explain a basic public key cryptography scheme.*

5. *In the IEEE 802.11g physical layer, the OFDM signal consists of 48 data + 4 pilot subcarriers carrying OFDM symbols of length 4 µs. The guard time for preventing intersymbol interference is 0.8 µs. Please calculate the following (remember to show all calculation steps):*
   a) Calculate the subcarrier spacing (i.e. frequency interval between adjacent subcarriers).
   b) Calculate or estimate the bandwidth of the OFDM signal.
   c) Assuming 64-QAM, how many bits/symbol does each subcarrier carry?
   d) Assuming 64-QAM, how many data bits does each OFDM symbol carry?
   e) Assuming 64-QAM and ¾ coding rate, calculate the usable data bit rate (i.e. data bit rate before coding or after decoding).