U.PORTO

FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

MIEEC | 4TH YEAR

EEC0043 | MOBILE COMMUNICATIONS | 2014/2015 – 2S

Closed books. Duration: 90 min   Part 2

1. **[2 val]** How is a Mobile Initiated Call processed in GSM?

2. **[2 val]** The IEEE 802.11ac technology is used to enable communications in wireless LAN at high speeds. Discuss the characteristics of this technology.

3. **[2 val]** In an ad-hoc network operating with the OLSR routing protocol, some of the nodes play the role of MultiPoint Relay (MPR). What is an MPR node, how is it elected, how does it behave, and what advantages does it bring to the network?

4. **[2 val]** The Public Land Mobile Networks have suffered evolutions. For the evolutions indicated below, describe the (i) main objective of the evolution, (ii) the main architectural modifications, and (iii) the gains obtained from the user and telecom operator points of view.
    a) **[0.5 val]** Evolution from GSM to GPRS.
    b) **[0.5 val]** Evolution from GPRS to UMTS.
    c) **[0.5 val]** Evolution from UMTS to HSPA.
    d) **[0.5 val]** Evolution from HSPA to LTE.

5. **[2 val]** Describe the behaviour of FastHandover in combination with Mobile IPv6.

1. [2 val] In a radio link the Packet Loss Ratio (PLR) observed at the receiver depends on a set of factors. Identify these factors and indicate how each factor affects PLR.

2. [2 val] TDMA, CDMA and OFDMA are multiple access techniques used by different generations of mobile communications systems. Characterize briefly each multiple access technique and compare them.

3. [2 val] Multi-hop wireless networks (e.g. ad-hoc networks, mesh networks) use routing protocols to discover the best path for packets. Identify routing metrics that can be used by these routing techniques and compare them.

4. [2 val] Let us assume that a new voice call is generated by a mobile phone. What procedures shall a LTE network carry out in order to decide if the call can be admitted?

5. [2 val] The Public Land Mobile Networks have suffered evolutions. For the evolutions indicated below, describe the (i) main objective of the evolution, (ii) the main modifications at the radio access, (iii) the main architectural modifications.
    a) [0.5 val] Evolution from GSM to GPRS.
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1. [2 val] In wireless networks the communications in both directions (duplex) can be made both on the frequency or time domains. Characterize and compare FDD and TDD.

2. [2 val] Let us assume that a new voice call is generated by a mobile phone. What procedures shall LTE and UMTS networks carry out in order to decide if the call can be admitted?

3. [2 val] Characterize the challenges associated to the 5th Generation of cellular networks and what are the main solutions that possibly will be adopted.

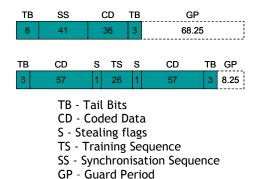4. [2 val] Describe in general terms how the mobility of terminals is managed in cellular networks.

1. **[2 val]** The figure below shows the formats of an access burst and of a normal burst used in GSM.

   a) **[1 val]** Explain why transmission bursts are used in this system;

   b) **[1 val]** Explain why guard periods are needed in the access and normal bursts – in your explanation show which factors determine their length, and why the guard period of the access burst is much longer than the guard period of the normal burst.

TB	SS	CD	TB	GP
8	41	36	3	68.25

TB	CD	S	TS	S	CD	TB	GP
3	57	1	26	1	57	3	8.25

TB - Tail Bits
CD - Coded Data
S - Stealing flags
TS - Training Sequence
SS - Synchronisation Sequence
GP – Guard Period

2. **[2 val]** How does the pair of messages RTS/CTS solve the hidden node problem?

3. **[2 val]** In an ad-hoc network operating with the OLSR routing protocol, some of the nodes play the role of MultiPoint Relay (MPR). What is an MPR node, how is it elected, how does it behave, and what are the advantages it brings to the network?

4. **[2 val]** The Public Land Mobile Networks have suffered evolutions. For the evolutions indicated below, describe the (i) main objective of the evolution, (ii) the main architectural modifications, and (iii) the gains obtained from the user and telecom operator points of view.

   c) **[0.5 val]** Evolution from GSM to GPRS.

   d) **[0.5 val]** Evolution from GPRS to UMTS.

   e) **[0.5 val]** Evolution from UMTS to HSPA.

   f) **[0.5 val]** Evolution from HSPA to LTE.

5. **[2 val]** The techniques studied for the mobility management of terminals have many characteristics in common. Describe, in abstract, a mechanism for managing the mobility of terminals. What optimizations could be applied to this mechanism in order to reduce the time interval during which the terminal loses its connection to the network, when moving?

1. **[2 val]** Wideband wireless links are affected by problems that are different from the problems affecting narrowband wireless links. In order to overcome the wideband problems, techniques such as Direct Sequence Spread Spectrum (DSSS) or Orthogonal Frequency-Division Multiplexing (OFDM) are being adopted.
    a) **[0.5 val]** Characterize the problems of wideband wireless links.
    b) **[0.8 val]** Describe the working principles of the DSSS and OFDM techniques.
    c) **[0.7 val]** Discuss how these techniques avoid the problems identified in a).

2. **[2 val]** Describe the mechanisms used by the IEEE 802.11 (WLAN) to save energy and discuss the impact they have on communications.

3. **[2 val]** The 802.11s mesh network has as default routing metric the *Airtime Link Cost*.
    a) **[1 val]** Describe the rational of this metric.
    b) **[1 val]** Characterize the advantages of using this metric in wireless mesh networks, by comparing it to the hop-count metric.

4. **[2 val]** The Public Land Mobile Networks have suffered evolutions. For the evolutions indicated below, describe the (i) main objective of the evolution, (ii) the main architectural modifications, and (iii) the gains obtained from the user and telecom operator points of view.
    c) **[0.5 val]** Evolution from GSM to GPRS.
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    e) **[0.5 val]** Evolution from UMTS to HSPA.
    f) **[0.5 val]** Evolution from HSPA to LTE.

5. **[2 val]** Please describe the handover operation in the 3GPP Long Term Evolution (LTE).