Wireless Internet – Questions
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Wireless Transmission
1. Identify the major differences between physical transmission on wired and wireless links.
2. Identify ways to minimize the total radio emission caused by the base stations of a cellular radio system.
3. Identify ways to improve the capacity of a cellular system.
4. What is the purpose of the use of multiple cells in mobile telecommunication systems?
5. Describe the differences between TDD and FDD and the pros & cons of each approach.
6. What is the problem of radio bands beyond 1 GHz?
7. What is the purpose of antenna diversity?
8. What are the causes of slow and fast fading, respectively?
9. What are the causes of multipath propagation?
10. Compare the effects of multipath propagation in FDMA and CDMA systems.
11. Why are Frequency Shift Keying and Phase Shift Keying preferable over Amplitude Shift Keying?
12. Where is Quadrature Amplitude Modulation (e.g. 16-QAM) applied, and why is its application limited?
13. What is the motivation for spread spectrum technology?
14. Compare the GSM and UMTS system from the radio perspective.

Media Access Schemes
1. What is the near-far problem?
2. What are the problems of CSMA/CD in a wireless system? When do carrier sensing and collision detection fail?
3. Why is it possible to use the same frequency in every cell in a CDMA network and not in a GSM network?
4. Compare the advantages of FDD and TDD for packet data and voice communication, respectively.
5. Compare Aloha and Slotted Aloha?
6. Compare random media access and reservation-based access with respect to response time and capacity under various loads.
7. Describe how CDMA works.
8. What are the factors limiting the radio capacity in GSM, GPRS, EDGE, and UMTS (W-CDMA), respectively?

Logical Link Control
1. What is the difference of error correction schemes in layer 2 and 4?
2. What is the difference between flow control in layer 2 and 4?

Mobility Management
1. Describe the tradeoff between size of paging area and signaling traffic in cellular networks.
2. Describe the different approaches to mobility management which may be employed in the different protocol layers.
3. Why is the IP address dynamically assigned to the mobile system typically not appropriate for routing and forwarding purposes within the Internet? Describe the tasks of the routers if the IP address is used for this purpose.
4. How does MobileIP work? What are the advantages and the limits of mobile IP?
5. How does triangular routing and reverse tunneling mean?
6. Sketch the extensions Hierarchical Mobile IP and Cellular IP.
7. Describe the difference between MobileIP and UMTS/GPRS mobility management.
8. Compare handovers in GSM from handovers in a system employing 802.11 and Mobile IP.
9. In which layer of the TCP/IP reference model should mobility be implemented to achieve a global roaming?
10. What are the benefits obtained from implementation of mobility in different layers of the TCP/IP reference model, discuss please each layer alone?
11. Compare between Mobile IP version 4 and version 6?

TCP/IP Review
1. Describe the flow and congestion control mechanisms in TCP.
2. What is the purpose of dupacks in TCP?
3. What is the purpose of the TCP window mechanism?
4. Describe the TCP behavior upon packet loss indicated by timeouts and dupacks, respectively.
5. What is the difference between the slow start mechanism and congestion avoidance?

Wireless Transport
1. What is the difference between transport on a wireless and a wireline link?
2. Why is TCP not well suited for wireless links?
3. Describe the extensions of TCP to better suite the wireless link. Discuss pro and cons of the approaches.

Quality of Service
1. Name the most critical applications for wireless systems. Why?
2. Describe the three basic principles to ensure Quality of Service.
3. What are the basic functions in a QoS-enabled system?
4. Describe the token bucket mechanism. What is the purpose of the mechanism?
5. What is the purpose of RED and weighted RED? Is there any dependence to higher protocol layers, e.g. TCP or UDP?
6. Describe how DiffServ works?
7. Describe how IntServ works?
8. Describe the pros and cons of DiffServ compared to the IntServ architecture.
9. Describe the terms “link”, “label”, “label switched path” (LSP) and “forwarding equivalent class” (FEC). How do the terms differ?
10. Describe the requirements to ensure that overprovisioning works
11. How can MPLS influence the provided QoS?

Security and Privacy
1. AAA Service
   a. What is Authentication, Authorization and Accounting? Describe their functions.
   b. Explain 4 Authentication methods: password, symmetric encryption, public key cryptography, challenge-response schemes
2. Describe the requirements of IPSec. Explain how authentication and encryption is implemented in IPSec.
3. Describe the security precautions to ensure that the data of an intranet remotely accesses by a mobile worker from outside the intranet, e.g. from a WiFi hotspot, are not compromised.

IEEE 802.11
1. Please draw the network architecture of an "infrastructure network" and an "AD hoc network" of 802.11 wireless LAN. Describe the difference between them. What's the function of an Access Point?

2. MAC layer
   a. What's the different between SIFS, PIFS and DIFS? (priority, function).
   b. What network contention protocol does 802.11 wireless LAN use? How does it work?
   c. How to control competing stations?

4. Describe the WEP encryption and decryption steps.

5. Describe the function of 802.1x, WPA and 802.11i. What are the differences?

GSM (not covered in SS04)
1. Describe the architecture of a GSM system and the function of the different network elements.
2. What is the difference between the HLR and VLR?
3. Sketch the different types of handover in GSM. Which network elements are involved in which type of handover.
4. Describe the handover procedure in the case of a change of the BSC. What does make-before-bread mean?
5. Describe the GSM authentication mechanism. In which network element is the authentication key stored?
6. Describe the the extensions to GSM to support packet-switched data.
7. What does HSCSD mean?
8. How can the data rate be increased? Describe the different approaches
9. What is the purpose of switching the modulation and/or coding scheme during transmission?

UMTS
1. What is the purpose of the separation of the core network and the radio access network? Identify the differences.
2. How differs the GSM network from a UMTS network (Release 3)? Identify differences in the core and the radio access network
1. What limits the capacity of the air interface in UMTS?
3. Describe the advantage of a packet network compared to a circuit switched network. Describe the problems of packet networks to support QoS requirements.
4. Identify and describe the elements of the UMTS core network.
5. What is the purpose of tunneling in the PS core network?
6. Which IP address in the RNC-SGSN-GGSN protocol architecture is used for routing (forwarding) purposes in the UMTS system? What is the purpose of the other IP addresses used in the lower layers of the UMTS protocol architecture?
7. What is the purpose of the composition of an end-to-end service from a set of bearer services? Outline the different bearer services of UMTS and describe their differences.
8. Why is session management more complicated than connection management?
10. How are multiple flows to a single UE (e.g. real-time video and ftp) with different QoS requirements supported?
11. What happens to the (user) IP address assigned to the UE when the mobile moves between SGSNs? What happens to the lower layer IP address used in SGSN and GGSN in this case?
12. Identify and describe the elements of the UTRAN.
13. Describe the term soft and softer handover. Which kind of information combining is used in the two modes? What is the difference?
15. What are the reasons that L1 and L2 are not completely terminated in the node B? Compare and identify the differences between shared and dedicated transport channels?

16. What is the purpose of different location areas in UMTS (LA, RA and URA)?