Sistemas de Computação Móvel e Ubíqua

2016/2017

First test: 24/04/2017
Duration: 2h
Closed book

1. Physical mobility of computing devices opens opportunities for new types of applications but, on the other hand, also raises many challenges.
   a. Present two applications that only make sense if executed in mobile devices.
   b. Present two challenges that device mobility adds to the known challenges of distributed systems.

2. Describe the phenomena of *Multipath Propagation*, and the problems it raises to wireless communications. Subsequently, explain how the phenomena may, in fact, be used to improve, rather than harm, the quality of wireless communications.

3. Consider a WiFi access point serving 5 mobile phones.
   a. Knowing that the WiFi signal fades with distance and obstacles, do all these 5 devices have to be in range of each other in order to communicate? Justify your answer.
   b. Is it ensured that all data packets sent by devices in this group reach their destination (i.e. are received by the destination device)? Justify your answer.
   c. Why the CSMA/CA protocol is used to coordinate the access to the shared medium in WiFi communication, instead of CSMA/CD, used in some wired network technologies?

4. Explain why *caching* is a crucial technique to enable disconnected operation in mobile computing systems. Additionally, present (justifying) another important advantage of using caching in this context.

5. Assume the role of a mobile application developer that is developing an app for displaying the timetables of an airport's arrivals and departures. The app may be used anywhere, naturally including the target airport.
   a. In this context does it make sense to use broadcast disks to deliver content to all or to some of the app's users? Why?
   b. Considering only the apps accessing the service from the airport's surroundings, what kind of cache coherence management protocol would you use: invalidation or update? Why?
   c. Assuming that the app's cache on the device is not big enough to hold the timetables of one (or more) airport's, what strategies could you use to ensure (as much as possible) that the users have the more important information (to them) up-to-date?
   d. How does the strategy of c) integrate with the cache management protocol of b), i.e. how do you decide which elements to keep in cache?

6. Consider the 3 state life-cycle of a CODA file-system client: *Hoarding*, *Emulation*, and *Reintegration*.
   a. Would these 3 states still make sense if the system was based on Conflict-Free Replicated Data Types (CRDTs)? Justify your answer, including which states you propose in case your answer to the question is "no".
   b. This 3 state life-cycle is a type of adaptation. Do you classify it as data or functionality adaptation? If you were asked to implement this adaptation using one or more proxies, would you place them on the server, the client or the infrastructure? Why?