Question 1

Discuss the two fundamental approaches presented in the lecture to develop software for mobile devices depending on the capabilities of a device.

- Server-based approach: create a web service and the client (the mobile device) accesses the content via a browser.

- Device-based approach: develop application with an SDK and deploy the application locally on the mobile device.

Assume that a wireless thin client has only a browser but no other software installed. Detail the necessary components to enable thin clients to access and store information via the Internet.

- Approach is a server (instead of a client) based approach that renders and processes most information tailored for a mobile device. Use of an Internet protocol that is more efficient than HTTP (e.g., WAP).

Question 2

Explain in what way a smartphone differs from a desktop PC with regard to user interfaces.

- Smartphones have different requirements: a single screen with no overlapping windows (no window manager required) and no complex tables; input often limited to keypad.

- A user interface for a PC is designed for a pointing device (mouse) and typically supports window managements (resize windows, move windows).

What is the purpose of Attributes for Text Fields using Android? Give some examples and discuss their purpose.

- Affect the way the device displays the data and the way a user enters the data. Examples are a normal text keyboard with the @ character or the characters entered turn into dots (textPassword).

We discussed user interfaces for mobile devices in the lecture. Discuss a few techniques for good user interfaces and explain why they are useful for mobile devices.

- Prefer: relative positioning, use of text, compressed images, etc. but avoid absolute positioning (different screen sizes), many pictures (performance & UI issues, horizontal scrolling, etc.

Question 3

In the class we divided mobile games into two categories. One category are event-driven games. What is the other category? Explain both categories and give game applications for each category.

The other category are time-driven games. Input- or event-driven games display the current state of game play and wait for user input/events before the next step. Examples are card games, puzzle games, strategy games, text adventures.

Time-driven games run continuously and do not wait for the player: updates occur with and without user input; examples: action and racing games.

Question 4

Compare the two classes of topological routing protocols for ad-hoc routing in terms of mobility.

- Topological routing protocols use information about links in the network. Proactive protocols compute routes before routing and reactive protocols discover routes on-demand.
-
- In contrast to reactive protocols, for proactive protocols there is no route discovery necessary (lower latency). In contrast to proactive protocols, reactive protocols do not require maintenance of routes necessary (lower overhead and storage costs).

What are the disadvantages of flooding? When is flooding used? How can we improve flooding?

- Flooding is often used as backup strategy or to find nodes. Disadvantages are implosion (a node receives the same message from different neighbors), duplication (nodes send the same message to their neighbors) and resource blindness (protocol is not aware of the energy levels of the mobile device). Improvement. Flooding with growing radius: for a message the time-to-live (TTL) is decreased at every node and we use rounds of different floods with increasing TTLs (1, 2, 3, …).

When is Rumor Routing a good choice for event detection and query dissemination in a sensor network?

- When the number of flooded events and queries is relatively small (see the last slide about rumor routing and explain this a bit).

Under which conditions can Directed Diffusion not outperform Flooding or Omniscient Multicast in terms of average dissipated energy?

- When the IDLE energy consumption is comparable to the transmission and reception energy consumption.

Question 5

Explain and discuss a non-range based localisation method.

- A non-range based localisation method does not use distance (angle) or range estimates (range) for computing a location. These techniques are very robust but imprecise. Techniques can be based on pressure or touch sensors such as the Smart Floor that is divided into tiles (each sensor one tile) or the use of RFID tags with an RFID scanner. Pick you localisation technology ☺

Discuss whether or not non-range based positioning techniques can be used for location-based services that safeguard location privacy using obfuscation.

- Non-range based positioning techniques are ideal in tandem with obfuscation. They only provide a set of possible locations. Imprecision is one of the key elements of obfuscation. A service provider that is able to deal with imprecision can easily provide LBSs for proximity-based positioning techniques.

Question 6

Compare Bluetooth to ZigBee. What do they have in common, how do they differ? Do not provide numerical details (for example, for their range and bandwidth). Instead, focus on a qualitative discussion. Furthermore, you do not need to mention applications.

- They are both WPANs and ad-hoc networks with no underlying infrastructure. They are designed for low cost, short-range communication with low power consumption in mind. Bluetooth and ZigBee penetrate obstacles and have a similar range.

- Bluetooth is designed as low-cost replacement for wires. ZigBee is designed for large networks and facilitates rapid joins whereas Bluetooth for small networks (slow joining).

Why does the ZigBee standard specifies a routing protocol whereas the Bluetooth standard does not specify one for piconets? Which protocol is part of the ZigBee standard?

- ZigBee is designed for large networks (several thousand nodes) whereas Bluetooth supports up eight nodes all in communication range. Thus, we need a routing protocol for a MANET. ZigBee uses AODV.

Discuss and explain the ALOHA protocol. Why is the ALOHA protocol not an efficient singulation protocol for RFID tags? How can it be improved?

- "Tag-Talks-First" behavior: tag automatically sends its ID (and data) if it enters a power field. If a message collides with another transmission, try resending it later after a random period. ALOHA is not efficient due its partial and complete collisions between packets, which leads to a small throughput. Furthermore, in the worst case ALOHA never finishes.

- Adapts quickly to changing numbers of tags and requires only a simple reader design. Improvement through Slotted ALOHA: "Reader-Talks-First": use discrete time slots SOF (start-of-frame) and EOF (end-of-frame), where a tag can send only at the beginning of a time slot; leads to complete or no collision; reader can send out an early EOF; but requires synchronization Group several slots into frames such that we have a single tag transmission per frame and limit frequently responding tags.

Compare LF and UHF RFID technology. Discuss their advantages and disadvantages.

- LF: Good penetration of materials including water and metal, but no singulation protocol and small range.

- UHF: Read range up to 3m and singulation protocols available, but no penetration of metal (behaves similar to light)