Service-centric NETWORKING
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Homework #5 | July 1, 2010

Problem #15: Location-based Services

The paper *Küpper/Treu/Linnhoff-Popien: Trax- A Device-centric Middleware for Location-based Services* (http://www.hh.se/download/18.48d95db011b94f87cc1800081370/kupper-trax-device.pdf) introduces different classes for LBSs and proposes a middleware for realizing them.

a) List the different categories of LBSs introduced in the paper and explain their fundamental key technologies and concepts! Give example applications for each category!

b) What are the differences between a network-centric and device-centric LBS value chain?

c) What are the major roles that actors in the supply chain may adopt?

Problem #16: Positioning

a) Explain the fundamentals of at least four popular positioning systems!

b) What are the assumptions for performing Time of Arrival and Time Difference of Arrival regarding clock synchronization?

c) What are the differences between terminal-based, network-based, and terminal-assisted positioning?

Problem #17: GPS Positioning

A user wants to derive its geographic position via GPS. Her or his GPS receiver has detected four satellites at the following positions:

s_1=(-10,000km, 0 km, 12,000)

s_2=(10,000km, 0 km, 8,000 km)

s_3=(0 km, 10,000 km, 11,000 km)

s_4=(0 km, -10,000 km, 10,000 km)

The positions are expressed in terms of a Cartesian coordinate system, which is known as Earth-centered Earth-fixed (ECEF) and which is used as an internal format for position calculation. After the position has been determined, the Cartesian coordinates are transferred to LLA (latitude, longitude, altitude).

Furthermore, her or his receiver has measured the following traveling times of the signals emitted by the satellites and caught by the receiver:

Δt_1=0.060s, Δt_2=0.027s, Δt_3=0.037s, Δt_4=0.055s

Determine the position by using the iterative algorithm (see Appendix of Chapter 9). Start with the following estimated values:

u_x=4,500km, u_y=4,500km, u_z=3,500km, t_u=0.00008s