Location-Based Services (Cont.)

An LBS system structure shown as below includes five major components:
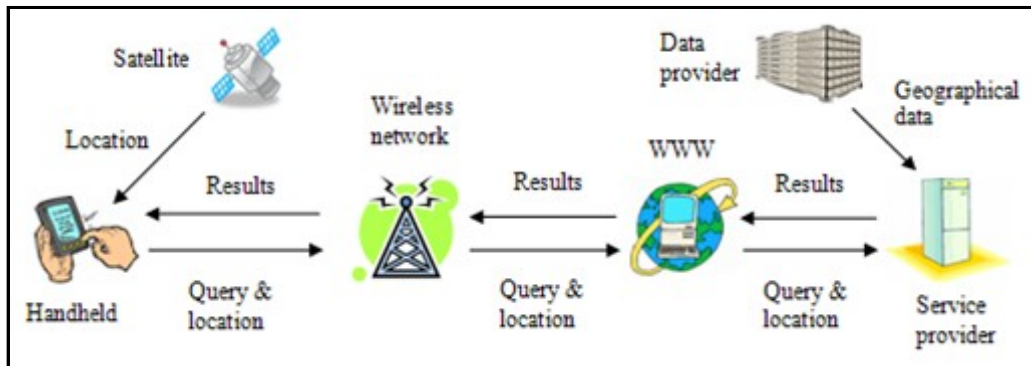
a. *Mobile handheld devices,* which are small computers that can be held in one hand. For most cases, they are smartphones.

b. *Positioning system,* which is a navigation satellite system that provides location and time information to anyone with a receiver. The user position can be obtained either by using the mobile communication network or by using the GPS. Further possibilities to determine the position are WLAN stations, active badges or radio beacons.

c. *Mobile and wireless networks,* which relay the query and location information from devices to service providers and send the results from the providers to devices

d. *Service providers,* which provide the location-based services like Foursquare. Such services offer the calculation of the position, finding a route, searching yellow pages with respect to position or searching specific information on objects of user interest (e.g., a bird in wild life park), and so forth.

e. *Geographical data providers,* which are databases storing a huge amount of geographical data such as information about restaurants and gas stations like GeoNames. Service providers usually do not store and maintain all the information requested by users. Geographical data and location information data are usually provided by the maintaining authority (e.g., mapping agencies) or business and industry partners (e.g., yellow pages).

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