20XW61 - Mobile Computing
Location Update in Cellular Systems

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Location update in cellular systems is a process by which a mobile device, such as a cell phone, communicates with the network to provide its current location information. The network uses this information to route incoming calls, text messages, and data to the appropriate cell site that can best serve the mobile device.

The location update process typically involves the following steps:

1. The mobile device periodically sends a registration message to the network, indicating its current location.
2. The network updates its location database with the latest location information for the mobile device.
3. When an incoming call or message is received for the mobile device, the network looks up the device's location information in its database and routes the call or message to the appropriate cell site.

The frequency of location updates can vary depending on a number of factors, including the type of cellular network, the location of the mobile device, and the mobility of the device. In general, mobile devices in urban areas with high population densities and high levels of mobility may require more frequent location updates than devices in rural areas with lower population densities and lower levels of mobility.

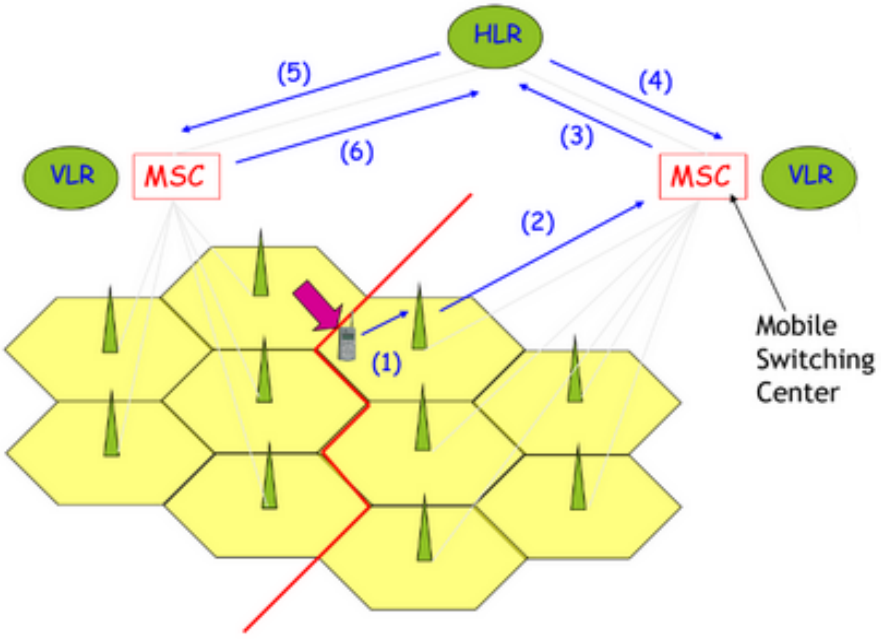
Overall, the location update process plays a critical role in ensuring that mobile devices can seamlessly communicate with the cellular network and receive incoming calls, messages, and data regardless of their current location.

2 important databases are used in cellular networks for managing information and providing location-based services.
These two databases communicate with each other to authenticate and update each other about the location of a mobile device.

1. **HLR (Home Location Register):** HLR is a centralized database used by the cellular network to store information such as phone numbers, services, and location information. HLR is responsible for managing mobility and is used by the network to route incoming calls, messages, and data to the appropriate cell site. The HLR database is updated when a mobile device registers with the network or changes location.

2. **VLR (Visitor Location Register):** VLR is a database used by the cellular network to store information about mobile devices that are currently visiting a particular location. VLR is located in the MSC (Mobile Switching Center) and is responsible for managing roaming locations. When a mobile device roams into a new location, the VLR database is updated with the mobile device's location information, and incoming calls, messages, and data are routed to the appropriate cell site.

The VLR database is temporary and is periodically updated with information from the HLR database. When a mobile device moves out of a particular location, the VLR database is updated with the new location information, or the mobile device’s information is removed from the database.
In summary, the HLR and VLR databases are important components of cellular networks that enable the network to manage information and provide location-based services such as call routing, messaging, and data services. The HLR database manages mobile device information, while the VLR database manages mobile device location information in roaming.



MS: Mobile Station
BS: Base Station
LU: Location Update
MSC: Mobile Switching Center
HLR: Home Location Register
VLR: Visitor Location Register
ACK: Acknowledge

1. MS transmits a LU to the new BS
2. The BS forwards the LU to the MSC
3. MSC sends LU to the HLR and updates VLR
4. HLR does the following:
    - authenticate the MS
    - record the ID of the new VLR
    - Send an ACK to the new VLR
5. HLR sends a registration cancellation message to the old VLR
6. The old VLR removes the record of the MS and returns an ACK to HLR