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Title: **LCS/LBS Enhancements**

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1. Summary

As wireless providers expand their offerings of Location Services (LCS), the capabilities and performance will shift from being dictated by emergency response requirements toward Location-Based Services (LBS). This paper presents the differences characterized by this shift and some of the specification enhancements necessary to meet these amplified requirements.

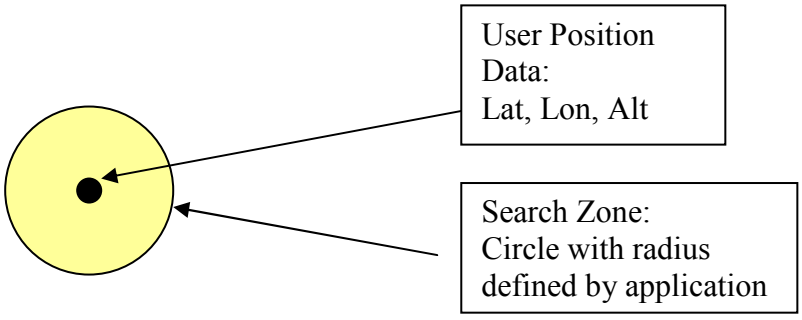
2. Issues

Initial LCS designs focused upon the need to meet mandated emergency services. Location-Based services differ from emergency services in significant areas:

Not just "Locate" but "Find and Navigate" – While an emergency service only asks "where are you?", many of the most interesting LBS detail answer "where should I go?" and "how do I get there. Reporting Points of Interest (POI) that fit a requestor's criteria not only uses knowledge of the user's location, but can have added value if the user's movement is taken into account; it might makes sense to help find restaurants of choice by detailing those where one is going rather than listing those already passed. An enterprise Dispatch and Delivery application can provide turn-by-turn directions only if it has knowledge of its asset's speed and direction of travel. As an example let's consider a point-of-interest service with the user requesting the closest Gas Station.

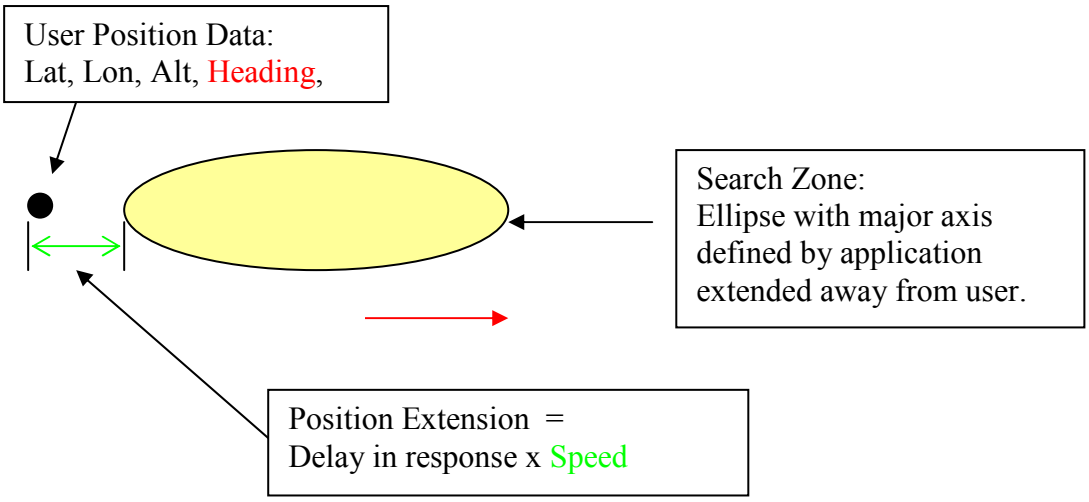
Only Location Information:

When the Application Server receives the location of the user, it looks for the closest Gas Stations within a circular vicinity of the user's position. If the user is on a freeway, such a solution may include gas stations that are in exits that the user just passed.



Location with Speed and Heading:

When an application receives speed and heading information, e.g. User is moving north on Highway 405 at 60 miles an hour, the application, knowing the delay in servicing the user's request, will provide information based on an elliptical search extending away from the current position. In addition, with speed and heading information being reported, the application will be able to provide dynamically-updated turn-by-turn directions to specific destination.



- **Continual position updates, not a single position report** – Emergency service location sessions are characterized by infrequent instances of a single position request. LBS will often require continual location reports to provide continual tracking, adaptive turn-by-turn directions, and updated information regarding the deployment of assets.

- **Improved Performance** – The initial goals for LCS performance originated with the US FCC E-911 mandated accuracy and response time. Specifically, for a mobile-based solution, the reported position was required to be within 50 meters of the actual position 67% of the time and within 150 meters 95% of the time. For network-based solutions, the accuracy was relaxed to 100 and 300 meters respectively. Even the most basic LBS require better accuracy; in urban areas, a reported position that is 150 meters in error will be displayed on the wrong street, 2 to 3 blocks away. Regarding response time, the mobile's location had to be reported to the requesting entity within 30 seconds. This is too long, as most LBS users will not wait for more than 7 to 10 seconds for a response from their application

3. Enhancements

- **Not just "Locate" but "Find and Navigate**" – An LBS application will need to be able to report a mobile's velocity to the requesting LCS client. Velocity, consisting of the speed of the unit and its direction of travel, can be provided

by the MS in a mobile-based solution or by the location server if using a network-based solution. This speed and heading information must be available in the messaging flow all the way to the LCS client.

- **Continual position updates, not a single position report** – As noted, emergency service location sessions consist of a single position request and a single position response. Many LBS offerings require near-continual location updates from the mobile. For example; a currently deployed mobile application in the U. S., is able to provide address location and turn-by-turn directions by receiving 1 Hz position reports from the mobile. Periodic reporting, enabled throughout the messaging chain, would mitigate the need for frequently-repeated position requests and eliminate the inefficiency and bandwidth usage inherent therein.
- **Improved Performance** – The most recent exercise in setting performance specifications (TS 25.171, Requirements for Support of Assisted Global Positioning System (A-GPS)) in RAN4 resulted in accuracy requirements at the 100 meter level with response times of 20 seconds. To ensure that a handset can be expected to adequately perform typical LBS applications, better accuracy and shorter response times need to be included in minimum performance specs that apply to LCS.

4. Next Steps

- **Not just "Locate" but "Find and Navigate**" – Velocity (as defined in TS 23-032 Universal Geographical Area Description) should be added as an optional part of all messages that contain a position report.
- **Continual position updates, not a single position report** – The network should maintain the ability to initiate periodic position updates from a single positioning request and the capability to accept multiple responses from that single request. This capability must be validated for all interfaces that process positioning requests and responses.
- **Improved Performance** – Creation of future minimum performance specifications should consider the nature of LBS applications through either tighter overall metrics or metrics based on UE classification in which one classification would ensure LBS-level performance

5. Moving Forward

- **Agree to specific enhancements that enable more robust LCS/LBS offerings**
- **Identify the specifications (architecture, requirements, and protocol) that need to be modified**
- **Pursue the desired modifications in the appropriate Technical Bodies and Working Groups**