ADAPTING AD HOC NETWORK CONCEPTS

to LAND MOBILE RADIO SYSTEMS

by

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ABSTRACT

Ad hoc networks are self-organizing networks of user terminals that form without the need for prior infrastructure. In theory, an ad hoc network could deliver adaptable, robust, and rapidly deployable communication services to meet the needs of public safety related agencies for emergency response and disaster recovery operations. In this project, I investigated the potential to develop a next generation land mobile radio system for public safety communications using ad hoc network architectures and concepts. I applied a four step methodology: (i) identify the communication requirements of public safety agencies in terms of the types of services, traffic characteristics, and quality of service; (ii) explore current technology and research relating to mobile ad hoc networks; (iii) conceptualize a design for a hypothetical next generation network by selecting approaches from the literature that should provide good results against the needs of public safety; and (iv) assess the potential performance of this hypothetical design. Among the many factors considered, the following four had a major influence on the design: (i) the dominant communication need is half duplex multicast voice; (ii) in most instances users have access to a vehicle; (iii) location information is becoming economically available through the Global Positioning System; and (iv) satellite-based mobile communications is available. The hypothetical network I propose is hierarchical with single hop "cluster nets" that are interconnected by a dominating-set based "backbone net". A satellite network tier simplifies routing across large geographic distances and provides a backbone of last resort for sparse networks. For the cluster net media access control, I applied the well known Packet Reservation Multiple Access protocol. The delay performance of this approach was investigated by applying genuine traffic traces to a software model of the cluster net. Before a complete terrestrial-based backbone net can be developed, further work is required; particularly in the area of multi hop routing. A central conclusion is that, although there are major challenges (e.g., spectrum, network self configuration algorithms, routing protocols, standards, and security), enough critical elements are available that prototypes and simple first generation systems can be built.

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