

**ADAPTING AD HOC NETWORK CONCEPTS  
to LAND MOBILE RADIO SYSTEMS**

by

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PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF  
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## Approval

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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.

## Table of Contents

Approval	
Abstract	
Table of Contents	
List of Tables	
List of Figures	
1	Introduction . . . . . 1
2	Operational Requirements for Public Safety Related Agencies. . . . . 3
2.1	Missions, Agencies, and Groups of Users
2.2	General Operational Requirements and Context
2.3	Communication Services and Applications
2.4	User Terminals
2.5	Quality of Service
2.6	Network Management
3	Traffic Characteristics of Public Safety Networks . . . . . 11
3.1	Voice Traffic Source
3.2	Traffic Analysis
3.3	Overall Voice Traffic Characteristics
3.4	Detailed Analysis of Call Holding Times
3.5	Detailed Analysis of Call Inter-arrival Times
3.6	Geographic Distribution and Mobility
3.7	Data Traffic
4	Conceptual Design of a Hypothetical Ad Hoc Network . . . . . 31
4.1	System Elements, Basic Organization, and Topology
4.2	Radio Frequency Spectrum
4.3	User Terminals
4.4	Addressing Scheme
4.5	Media Access Control Protocol
4.6	Multi Hop Routing
4.7	Network Management
4.8	Application Design
4.9	Conceptual System Design Summary

5	Preliminary Feasibility of the Hypothetical Ad Hoc Network	52
5.1	Performance Evaluation Scenarios	
5.2	Connectivity Performance	
5.3	Capacity Performance	
5.4	Delay Performance	
5.5	Cost Estimates	
5.6	A Possible Phased Development Program	
6	Conclusions	.64
Appendix A	Selected Terminology	.66
Appendix B	Primer on Ad Hoc Networks	.67
Appendix C	Primer on Mobile Radio Systems	.83
List of References		.87

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