ABSTRACT

Recent advances of wireless networks play an increasingly significant role in disaster response. Disaster response and recovery require timely interaction and coordination of disaster responders in order to save human life and property. Land mobile radio network (LMR) is a wireless network, which is used by public safety agencies in the disaster environment for the disaster rescue. Most public safety land mobile radio networks provide only limited support of low speed data services, which is not efficient for the emergency communication. Due to the limitation in land mobile radio network (LMR) services, public safety agencies have undergone many difficulties to rescue the human life in the disaster environment. This limitation should be minimized in the disaster environment to save human life and property.

The 3G cellular networks and 4G cellular networks support a variety of multimedia application, which includes higher data rates, voice, video and web browsing. Therefore, Land mobile radio (LMR) accesses the cellular network radio resources for getting a wide variety of benefits such as new multimedia services, increased data rates. The heterogeneous wireless network supports the handoff mechanism in which users maintain the connections, when they switch from land mobile radio(LMR) network to
cellular network and vice versa. The increased data rates and multimedia service are offered to disaster responders in heterogeneous wireless network for fast response. There are challenges such as handoff delay, disconnection (no seamless), service availability problem and service continuity problem has been occurring to access other network services and technologies.

Most of the existing protocols are discussed in the network layer, transport layer and application layer for the heterogeneous wireless network problems. Among these solutions, application layer protocol named as Session Initiation Protocol only achieves true end to end mobility without the need to modify the network architecture. Based upon Session Initiation Protocol (SIP), handoff is a greatest issue in research for the past ten years.

Session Initiation Protocol (SIP) is developed by IETF for initiating, modifying and terminating multimedia sessions. SIP, a widely accepted signaling protocol and it is capable of providing mobility support at the application layer. SIP is a simple, text based protocol that offers a number of benefits, including extensibility and provision for handoff session control. SIP based handoff solutions is still not good enough in the interworking public safety LMR and cellular network for emergency communication because SIP has been used “Break-before-make” mechanism.
Radio resource is one of the most important sources in wireless networks. Multimedia applications are resource intensive in wireless networks. To provide good quality of service to end users, optimal radio resource utilization is needed. Optimal radio resource utilization is one of the major challenges in designing inter-operable public safety land mobile radio network and cellular network.

This thesis describes two proposed approach to solve the handoff, radio resource utilization and inter-operability issues. The first approach, Seamless Session Initiation Protocol (S-SIP) with Optimal Radio Resource Utilization framework is proposed to ensure reduction of handoff delay, increase the radio resource utilization for service availability and service continuity. The “Make-before-break” mechanism is used in Seamless SIP scheme (S-SIP). The second approach, Session schedule manager scheme is proposed to improve the inter-operability performance between public safety land mobile radio (LMR) and cellular network.

Interworking public safety LMR and cellular network are modeled as heterogeneous mobile wireless network (HMWN) for emergency communication, whose performance metrics such as session blocking probability, handoff dropping probability are calculated by analyzing experimental data for service availability and service continuity. As a result, it is found that the proposed schemes performed better than existing schemes sometimes that is double.