

Tactical Wireless Networks: A Survey for Issues and Challenges

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Abstract—As network centric warfare becoming the key concept in the modern military doctrine, tactical wireless networks have been used extensively throughout military operations for sharing crucial information among deployed units. Most tactical wireless networks are operating in a hostile environment, in which normal network operation cannot be easily achieved. In military operations, tactical wireless networks have high demands for robustness, responsiveness, reliability, availability and security. These requires continuous development of new technologies in order to cope with random behaviours of hostile environment. However, the random behaviour of tactical wireless networks under hostile environment has not been fully understood. This paper provides a survey on current issues, and research challenges in tactical wireless networks due to hostile environment. Several research gaps in performance, security, routing, and management of tactical wireless networks that are needed to be improved, are pointed out to pave the way for future research in this area. This paper provides insight understanding about the issues and trends for future development of tactical wireless networks.

I. INTRODUCTION

Wireless communication via radio signal has been involved in military operation since the World War I. Telegraph radios were installed on ship and shore to provide wireless communication over long distance. A radio was carried on an airplane to provide communication between a pilot and ground headquarter. The reliability of the wireless communication at that time was very low, which made it less attractive in military operations. During World War II, wireless communication had been evolved rapidly. Voice communication through wireless channel became more reliable. Each deployed force must be equipped with a portable radio to provide communication between forces. The wireless technologies during that time were based on analog signals and operate in point-to-point or broadcasting manner. [1]

In the current stage of military wireless communication, the technologies are based on digital technology. Current wireless communication is not only capable of transmitting voice but also capable of transmitting data. The demands for data transmission over wireless channel have been increased, since various information such as troops' position and sensor data is needed to be shared among military units to provide situation awareness in the area without network infrastructure. As a result, wireless networking has been integrated to the system to provide sharing of information of deployed units. Wire network is still existed along with wireless network as a backbone network. Due to the nature of each military

force, each force develops its own network with different protocol and topology. This restriction prevent interoperability of wireless networks among different forces.

The military operations are moving toward the concept of Network-Centric Warfare (NCW), in which a network is a source of crucial information for a mission. The power of NCW is relied on the effective networking of each entity involved in the operation [2]. The networking of entities enables sharing of information, which can be developed to share the situation awareness in the battlefield. Due to the nature of military operation, fast deployment of forces is required and units equipped with wireless communication device are always moved. Wireless networking is preferred over wire network. Mobile nodes can communicate in ad-hoc manner to build up a network. A network should be scalable when there is a node joining or leaving the network. The future wireless network must be globally operable without wired backbone network. In addition, interoperable of heterogeneous wireless networks will be needed in joint operation of different forces.

Tactical wireless network is a term used for the wireless network supporting military operation in the battlefield. It contain special characteristics that cannot be found in commercial wireless network. The key characteristic is that tactical wireless network must be able to operate under hostile environment. The hostile environment is the environment that is unfriendly to network operation. The factors that define a hostile environment include high mobility nature of military force, interferences from surrounding, and hostile attacks by enemies. These unfriendly factors cause a large magnitude uncertainty in tactical wireless networks operating in hostile environment.

This paper provides a brief survey on the issues and researches on tactical wireless networks. Some research gaps and challenges in the area of tactical wireless networks are also discussed. Section II gives the brief summary about a tactical wireless network in a hostile environment and key factors defining a hostile environment. Section III discusses the issues in a tactical wireless network due to a hostile environment. Section IV provides the review on past and recent researches related to a tactical wireless network. Then, Section V states the research challenges in a tactical wireless network that may become research opportunities in the future. Finally, the study is concluded in Section VI.