



School of Electrical and Computer Engineering  
Inter-office Memorandum

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*Scheduling of Examinations:*

Student's Name: Donghoon Shin  
Degree: Doctor of Philosophy  
Type: Final Exam

Major Professor: SAURABH BAGCHI  
Advisor 1: CHIH-CHUN WANG  
Advisor 2: NESS B. SHROFF  
Advisor 3: XIAOJUN LIN

Examination Date: 07-19-2012  
Examination Time: 2:00 PM  
Building & Room: MSEE 239

Thesis Title: Algorithms for Distributed Monitoring in Multi-Channel Ad Hoc Wireless Networks

Abstract: Ad hoc wireless networks are vulnerable to a wide range of security attacks, due to the ease of the nodes being compromised and the cooperative nature of these networks. A solution approach widely used for defending these networks is behavior-based detection. In this, nodes overhear communications in their neighborhood exploiting the open nature of the wireless medium, and determine if the behaviors of their neighbors are legitimate. An important issue with behavior-based detection that arises in multi-channel ad hoc wireless networks is on which channels monitoring nodes should overhear their neighbors' communications.

In this dissertation, we develop a framework for behavior-based detection in multi-channel ad hoc wireless networks. We are interested in the issue of how to optimally place monitoring nodes and to select channels to tune their radios to. We show that the problem is NP-hard, then develop approximation algorithms. We show that one of our algorithms attains the best approximation ratio achievable among all polynomial-time algorithms. Also, we develop distributed channel assignment algorithms for large-scale and dynamic networks. The distributed nature of the algorithm allows it to scale to large networks. Further, we allow for imperfect detection, where monitoring nodes may probabilistically fail to detect malicious behaviors. For this scenario, we consider providing multiple covers to each node, thereby still maintaining the detection accuracy above a certain level. We evaluate our algorithms for random and scale-free networks and consider optimizations for practical deployment scenarios, such as when the network configuration is changing fast versus a relatively static network.

Committee Members: If you are unable to attend this examination, please contact Mr. Shin.