

Possible projects for PhD and MCIS thesis

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PhD Projects

- Performance estimation of VoIP over WLANs
- Traffic dimensioning of WLANs using simulation and modelling
- Automatic planning and optimisation of in-building WLAN systems
- Wireless mesh network architecture: modelling and performance evaluation
- Modelling and optimisation of wireless mesh network MAC protocols
- Performance studies of routing protocol for MANETs
- Cross-layer design optimization for WLANs
- Energy efficient and QoS aware MAC protocols for WLANs: Modelling and performance evaluation (Student: Shuib Memon)
- Service based multi-channel adaptive information for wireless ad hoc networks (Rajesh Ramraj)

Projects for MCIS Thesis/ Dissertation

1. Performance study of IEEE 802.11g in noise and interference environments (Student: Hao Zhang)

This project aims to investigate the throughput performance of a typical IEEE 802.11g WLAN under noise and interfering environments. In particular, the correlation between signal to noise and interference ratio (SNIR) and link throughput will be determined. Radio propagation measurements as well as simulation methodology will be used for performance study.

2. Performance study of IEEE 802.11 WLANs in the presence of hidden stations (Student: Xun Dai)

When a wireless station is in the range of receiver but not in the range of a transmitter, can lead to increased number of collisions. Such a station is referred to as a hidden station. The performance of a typical WLAN can be affected by hidden stations. This project aims to study the performance of IEEE 802.11 WLANs in the presence of hidden stations. The performance metrics, such as mean packet delay, throughput, packet dropping, and fairness will be examined. The propagation measurements as well as system simulation will be used for performance analysis.

3. Performance study of 802.11a networks

Both 802.11b and 802.11g operate at 2.4 GHz and they support up to 11 Mbps and 54 Mbps, respectively. However, 802.11a operates at 5 GHz and has different radio propagation characteristics than those of 802.11b/g. The impact of using 5 GHz signals on WLAN performance especially in obstructed office spaces and residential houses has not been fully investigated yet. This project aims to investigate throughput and response time in obstructed office and residential houses. The effect of noise and co-channel interference on system performance will be examined.

4. A study of the impact of walls on the performance of a typical 802.11 network in obstructed office environments

It is obvious that the large number of office walls/partitions would completely block the radio signal and consequently break down communication between a sender (Tx) and a receiver (Rx). It is useful to be able to know what happens if only 3 or 4 walls blocked the line-of-sight (LOS) signal between Tx and Rx. This study is useful for design and deployment of indoor wireless local area network (WLAN) systems. This project aims to study the performance of 802.11 networks at different distances with fewer walls between the Tx and Rx in obstructed office spaces and suburban residential house environments. Radio propagation measurement methodology will be used for performance study.

5. Modelling and performance evaluation of a routing protocol for MANETs

A mobile ad-hoc network (MANET) is a collection of wireless nodes communicating with each other using multi-hop wireless links without any existing network infrastructure or centralised administration. In MANETs, network topology changes frequently and unpredictably making routing protocols in such networks more challenging compared to wired networks. A good understanding of the routing protocols for MANETs is required for efficient design and performance improvement of such systems. This project aims to propose an improved routing protocol for MANETs. The performance of the proposed routing protocol will be evaluated by simulation. Performance metrics such as mean packet delay, throughput, path length and quality, and routing overhead will be examined.

6. Modelling and optimisation of wireless mesh network MAC protocols

As wireless mesh networks (WMNs) are becoming attractive solution for providing low-cost and high-speed Internet access citywide. Performance analysis and optimisation of these networks are required for efficient design and deployment of such systems.

This research aims to develop a realistic analytical model to optimise the performance of 802.11-based medium access control (MAC) protocols for WMNs in both ideal and error-prone channels. Various factors such as the number of contending nodes, traffic load, contention window size, packet overhead and channel conditions, affecting the performance WMNs will be analysed. The analytical models will be validated using computer simulation.

The prospective student should have a strong background in Mathematics together with wireless communications and networking. A good working knowledge of MATLAB and network simulation packages (OPNET and ns-2) is required.

7. Performance modelling of congestion control mechanisms in wireless mesh networks

IEEE 802.11-based wireless mesh network (WMN) is an attractive solution for providing low-cost and high-speed Internet access citywide. A good understanding of the congestion control mechanisms in WMNs is required for efficient design and dimensioning of such systems. This project aims to study existing congestion control mechanisms and propose an improved mechanism for WMNs. The performance evaluation of the proposed scheme will be carried out by simulation.

8. A study of routing protocols for wireless mesh networks

Routing protocols play an important role in determining the performance of wireless mesh networks (WMNs). This project aims to study the existing routing protocols and propose an improved routing protocol for WMNs. Computer simulation methodology will be used for performance evaluation of the proposed protocol. Performance metrics such as mean packet delay, throughput, path length and quality, and routing overhead will be examined.

9. An investigation on the impact of traffic distribution on WLAN performance

A good understanding of the traffic arrival distributions at the stations is required for efficient design and dimensioning of wireless local area networks (WLANs). This project aims to investigate the impact of traffic arrival distributions on the performance of a typical 802.11 WLAN. Propagation measurements as well as simulation will be used for performance study.

10. A study on the combined effect of received signal strength and video streaming on WLAN performance

This project aims to address the following research question:

What impact do the different received signal strength (RSS) values and video streaming have on wireless local area network (WLAN) performance? In particular, how sensitive are video quality of service parameters (e.g. playback delay) to changes in the channel states. Radio propagation measurements and simulation will be used for performance study.

11. Modelling and performance studies of ATM networks

Asynchronous transfer mode (ATM) networks use a cell relay protocol designed by the ATM Forum and adopted by the ITU-T. ATM networks provide a better quality of service (QoS) compared to the Ethernet networks. This project aims to analyse the performance of an ATM network. In particular, this research investigates the impact of cell length as well as traffic type on a typical wide-area ATM network. Simulation will be used for performance analysis.

12. QoS schemes for IEEE 802.11 DCF WLANs

The original IEEE 802.11 wireless local area network (WLAN) lacks quality of service (QoS) schemes to support real-time applications. This project aims to propose an enhanced MAC protocol to include a QoS (e.g. real-time applications) provision in the IEEE 802.11 protocol. Simulation modelling will be used for performance analysis.

13. Improving TCP performance in MANETs

Transmission control protocol (TCP) is not originally design for use in the MANET environments, and therefore it raises a serious performance issues. This project aims to investigate methods of improving TCP performance in MANETs. Simulation methodology will be used for performance study.

14. Performance study of VANETs using Wi-Fi

Research in VANETs has attracted a lot of interest in recent years. This project aims to investigate the performance of vehicular ad hoc networks (VANETs) using Wi-Fi gear. The performance metrics, such as channel utilisation, packet delay, throughput, and packet dropping will be examined. The propagation measurements as well as simulation will be used for performance analysis.

15. Performance Studies of IEEE 802.16-Based Mobile WiMAX

The mobile WiMAX has been standardized by IEEE 802.16e working group in recent years, and is becoming an attractive solution for low cost broadband Internet access technology. A good understanding of the performance of mobile WiMAX is required for efficient deign and deployment of such technologies. This research aims to study the impact of traffic type (e.g. data, voice, and video) and mobility on the performance of a typical WiMAX. In the investigation simulation methodology will be used. Performance metrics such as throughput, end-to-end delay, packet loss, and jitter will be used for performance evaluation.

16. Modelling and performance evaluation of IEEE 802.15-based WPANs

A medium access control (MAC) protocol is one of the key elements that determine the performance of Bluetooth wireless personal area networks (WPANs). This project aims to develop an improved MAC protocol for WPANs. Simulation and/or analytical methodology will be used for performance evaluation of the proposed protocol.

17. Improved security mechanism for IEEE 802.11-based WLANs

Although IEEE 802.11-based wireless local area networks (WLANs) are gaining popularity in both business and home networking applications worldwide, WLAN security remains an ongoing concern. The rapid deployment of WLANs has further emphasised the security vulnerabilities in the 802.11 standard. Clearly, the 802.11 standard has security flaws in both authentication and encryption. This project aims to propose an alternative security enhancement method for 802.11 networks.

18. Rapid risk management framework for e-commerce

One of the challenges faced by e-commerce companies is to manage the potential threats and risks effectively in a short period of time. This project aims to develop a robust framework for rapid risk management in e-commerce and online businesses by combining risk management modelling and database (knowledge base). The idea is to get information of the 'threat history' (i.e. new threat or old threat) and share this knowledge with risk management database, so that the system can operate efficiently even in the high-risk situation. The performance evaluation of the proposed risk management framework will be carried out by real data and/or computer simulation.

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