### Contents

	Pages
List of figures	V
List of tables	xii
List of symbols	xii
Chapter 1 Introduction	
1.1 Mobile Ad hoc Networks	1
1.2 Importance of Synchronization	2
1.3 Research Objectives	3
1.4 Approach to Work	3
1.5 Thesis Organization	4

# Chapter 2

# A Review on Mobile Ad hoc Networks and Role of Orthogonal Frequency Division Multiplexing

2.1	Introduction	6
2.2	Ad hoc Networks	7
	2.2.1 Mobility in Ad hoc Networks	8
	2.2.2 Architecture of MANET	11
	2.2.3 Some performance metrics	24

2.3	High Speed Mobile Ad hoc Networks	26
	2.3.1 Issues related to high speed services	26
	2.3.2 Approaches to support high-speed services in MANET	27
2.4	Orthogonal Frequency Divisional Multiplexing	28
	2.4.1 Principle of OFDM	29
	2.4.2 Advantages of OFDM	34
	2.4.3 Limitations of OFDM	35
2.5	Synchronization in OFDM Systems	39
	2.5.1 OFDM signal model	39
	2.5.2 Effects of timing offset	41
	2.5.3 Effects of carrier frequency offset	42
	2.5.4 Timing and frequency synchronization schemes for OFDM	45
2.6	Data-aided Synchronization Schemes	47
	2.6.1 Data aided timing synchronization schemes	48
	2.6.2 Data aided frequency synchronization schemes	50
	2.6.3 Residual frequency offset and its effects	54
2.7	Multi-Band OFDM (MB-OFDM) UWB System	56
	2.7.1 UWB system	57
	2.7.2 MB-OFDM system	57
	2.7.3 UWB channel model	60
2.8	Cross-Layer Design Approach for Mobile Ad hoc Networks	62
	2.8.1 Importance of cross layer design	62
	2.8.2 Some design approaches	63
2.9	Chapter Summary	65

## Chapter 3

#### Studies on MANET for Facilitating Cross Layer Design

3.1	Introduction	67
3.2	Description of Simulation Environment	68
3.3	Studies on Routing	70
3.4	Studies on MAC Protocol	73
3.5	Studies on Physical Layer	74
3.6	Results and Observations	75
3.7	Comparison of AODV and DSR Routing Protocols	76
3.8	Chapter Summary	79

## Chapter 4

# Frequency and Timing Offset Estimation Schemes for OFDM Based Systems

4.1	Introduction	92
4.2	Residual Frequency Offset Estimation for OFDM Based WLAN Systems	94
	4.2.1 Residual frequency offset estimation	94
	4.2.2 An improved residual frequency offset estimation scheme	96
	4.2.3 Results and observations	100
4.3	Timing Synchronization Scheme for OFDM Based WLAN Systems	101
	4.3.1 Typical issues for good timing synchronization	102
	4.3.2 A new timing synchronization scheme	103
	4.3.3 Results and interpretation	105

4.4	Frequency Offset Estimation for MB-OFDM Based UWB Systems	106
	4.4.1 MB-OFDM systems and the issue of frequency offset	107
	4.4.2 Our frequency offset estimation technique for MB-OFDM systems	110
	4.4.3 Performance analysis	113

113

Chapter 5

4.5 Chapter Summary

# Cross Layer Interaction and a Design Approach for MANET

5.1	Introduction	125
5.2	A System Model for Cross Layer Interaction	126
	5.2.1 Cross layer interaction study of PHY layer	128
	5.2.2 Simulation environment	128
5.3	Cross Layer Interaction of PHY on Higher Layers of MANET	129
5.4	Cross Layer Design Approach and A Case Study For PHY and MAC Layers	133
5.5	A Case Study for Cross Layer Design Approach Involving PHY and	136
	Routing Layers	
5.6	Chapter Summary	138
Ch	apter 6	
Co	nclusions	151
Ref	ferences	155