Project No: Xxxxx-xxx

Resource Allocation in Multihop Cellular Networks

Submitted by: Xxx Xxx

Supervisor: Xxxx
Co-supervisor: Xxxx

School of Electrical & Electronic Engineering

A final year project report presented to the Nanyang Technological University
in partial fulfilment of the requirements of the degree of
Bachelor of Engineering

20xx

Table of Contents

Abstract ***(not more than one page)*** i

Acknowledgements **(optional)** i

Acronyms **(optional)** iv

Symbols **(optional)** ivv

List of Figures v

List of Tables vi

Chapter 1 Introduction 1

1.1 Movitations 1

1.2 Objectives and Scope 1

1.3 Organisations 1

Chapter 2 Literature Review 2

2.1 xxx 2

2.2 xxx 2

Chapter 3 xxx 3

3.1 xxx 3

3.2 xxx 3

(More chapters are usually required and can be inserted here)

Chapter 4 Conclusions and Future Work 4

4.1 Conclusions 4

4.2 Recommendatin in Future Work 4

Reflection on Learning Outcome Attainment 5

References 6

Appendix ***(optional)*** 7

Abstract

Multihop cellular networks (MCNs) incorporate wireless ad hoc networking into *traditional* single-hop cellular networks (SCNs) and thus they enjoy the flexibility of ad hoc networks, while preserving the benefit of using infrastructure of SCNs. In this Thesis, we study the resource allocation problems in MCNs.

Xxxx …

Acknowledgements (optional)

First of all, I would like to express my sincere thanks and great gratitude to my parents.

…

Xxx Xxx

November 2009

Acronyms (optional)

2G	Second Generation
3G	Third Generation
ACA	Adaptive Channel Assignment
AP	Access Point
ARS	Ad-hoc Relaying Station
ASP	Adaptive Switching Point
ATDMA	Advanced Time Division Multiple Access
BS	Base Station
CAMA	Cellular Aided Mobile Ad-hoc Network
CBM	Cellular Based Multihop Systems
CDD	Code-Division Duplexing
D-PRMA	Distributed PRMA
DA	Demand Assignment
DCA	Dynamic Channel Assignment

Symbols (optional)

B	channel bandwidth in Hz
C	channel capacity in bps; number of collisions in time slot t
d	distance
D	minimum reuse distance
D_a	average message access delay
D_{id}	inter-datagram-arrival time
D_{max}	maximum tolerable delay for voice packets
D_{pc}	reading time between two consecutive packet call requests

List of Figures

Figure 1.1: Proposed CMCN architecture. 10
Figure 1.2: TDD-CDMA MCNs with fixed RSs. 13
Figure 2.1: Illustration of FDMA, TDMA and CDMA. 16
Figure 2.2: Near-far effect in CDMA cellular systems. 21
Figure 2.3: Illustration of channel borrowing schemes. 25
Figure 2.4: Structure of reuse partitioning. 26
Figure 2.5: Classifications of medium access control protocols. 36
Figure 2.6: Frame structure of PRMA. 39
Figure 2.7: Frame structure of PRMA++. 43
Figure 2.8: Illustration of IPRMA. 44
Figure 3.1: (a) Single-hop cellular networks and (b) Multihop cellular networks. 53
Figure 3.2: Direct transmission vs. multihop transmission. 54
Figure 3.3: Coverage extension to dead spots by relaying. 56
Figure 3.4: The primary relaying strategy in iCAR. 60
Figure 3.5: Virtual cellular network. 61
Figure 3.6: Two ways of constructing MCNs. 63
Figure 3.7: Illustration of the UCAN architecture. 64
Figure 3.8: Illustration of the CMCN architecture. 66
Figure 3.9: Illustration of inter-microcell handoff in CMCN. 67
Figure 3.10: Cell and multihop cell in HMCN. 69

List of Tables

Table 2-1: ACO matrix at BS *i*. 30
Table 3-1: Comparison of selected MCN architectures. 74
Table 4-1: Call blocking with different (N_0, N_1) combinations at ρ=5 Erlangs. 103
Table 4-2: System capacity for uplink and downlink vs. channel combinations. 107
Table 5-1: Interference Information Table for uplink. 113
Table 5-2: Interference Constraint Table for the simulated network. 113
Table 5-3: Packing-based Channel Searching for uplink. 116
Table 6-1: System parameters for TDD CDMA systems. 139
Table 6-2: Supported number of simultaneous voice users. 146
Table A-1: Example of uplink call combinations for state (8,2,1,2,1,3,2). 164
Table B-1: Example of downlink call combinations for state (24,2,1,2,1,3,2). 168

Chapter 1

Introduction

This chapter……..

1.1 Motivations

This thesis deals with the problem of the blind multiuser detection for DS-CDMA …

1.2 Objectives and Scope

The communication channel considered in this thesis is assumed to be slow time-varying,

...

1.3 Organisations

….

Chapter 2

Literature Review

2.1 xxx

2.2 xxx

Chapter 3

xxxx

3.1 xxx

3.2 xxx

Chapter 4

Conclusions and Future Work

4.1 Conclusions

…

4.2 Recommendation in Future Work

…

Reflection on Learning Outcome Attainment

Reflect on your experience during your FYP and the achievements you have relating to at least three of the points below:

- *Engineering knowledge*
- *Problem Analysis*
- *Investigation*
- *Design/development of Solutions*
- *Modern Tool Usage*
- *The Engineer and Society*
- *Environment and Sustainability*
- *Ethics*
- *Individual and Team Work*
- *Communication*
- *Project Management and Finance*
- *Lifelong Learning*

References

[1] R. Jordan and C. T. Abdallah, "Wireless communications and networking: An overview," *IEEE Antennas and Propagation Magazine*, vol. 44, pp. 185-193, February, 2002.

[2] J. E. Padgett, C. G. Gunther, and T. Hattori, "Overview of wireless personal communications," *IEEE Communications Magazine*, vol. 33, pp. 28-41, January, 1995.

[3] G. L. Stuber, *Principles of Mobile Communication*, 1st ed. New York: Springer, 1996.

[4] GSM Association, "Worldwide cellular connections exceeds 2 billion," http://www.gsmworld.com/news/press_2005/press05_21.shtml, 2005.

[5] The Portio Research Limited, *Worldwide Mobile Market Forecasts 2006-2011*, 1st ed. Market Study, UK, 2006.

[6] P. Chaudhury, W. Mohr, and S. Onoe, "The 3GPP proposal for IMT-2000," *IEEE Communications Magazine*, vol. 37, pp. 72-81, December, 1999.

[7] A. Urie, M. Streeton, and C. Mourot, "An advanced TDMA mobile access system for UMTS," *IEEE Personal Communications*, vol. 2, pp. 38-47, February, 1995.

[8] H. Holma and A. Toskala, *WCDMA for UMTS: Radio Access for Third Generation Mobile Communications*, 3rd ed. Chichester, West Sussex, UK: John Wiley & Sons, 2004.

[9] H. H. Chen, C. X. Fan, and W. W. Lu, "China's perspectives on 3G mobile communications and beyond: TD-SCDMA technology," *IEEE Wireless Communications*, vol. 9, pp. 48-59, April, 2002.

[10] C. E. Perkins, *Ad Hoc Networking*, 1st ed. Boston MA, USA: Addison-Wesley, 2001.

[11] C.-Y. Chong and S. P. Kumar, "Sensor networks: Evolution, opportunities, and challenges," *Proceedings of The IEEE* vol. 91, pp. 1247-1256, August, 2003.

[12] A. Bria, F. Gessler, O. Queseth, R. Stridh, M. Unbehaun, J. Wu, J. Zander, and M. Flament, "4th-generation wireless infrastructures: Scenarios and research challenges," *IEEE Personal Communications*, vol. 8, pp. 25-31, December, 2001.

[13] S. Y. Hui and K. H. Yeung, "Challenges in the migration to 4G mobile systems," *IEEE Communications Magazine*, vol. 41, pp. 54-59, December, 2003.

[14] A. K. Salkintzis, "Interworking techniques and architectures for WLAN/3G integration toward 4G mobile data networks," *IEEE Wireless Communications*, vol. 11, pp. 50-61, June, 2004.

Appendix (optional)