Title of the Thesis

A Thesis
Presented to
The Academic Faculty

by

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In Partial Fulfillment
of the Requirements for the Degree
Master of Science in the
Graduate Institute of Communication Engineering

National Taiwan University

July 2012

ABSTRACT

Low Earth Orbit (LEO) satellite network has been a promising technology due to the wide spread coverage area and high data throughput. However, with the high speed of satellites, frequent handover is unavoidable for user equipments (UEs) on the ground, causing significant interruption time and signaling overhead. Thus, we introduce a quasi-earth-fixed satellite beam scheme to solve the continually handover from the UEs at the cell edge. In this scheme, we allocate the satellite beams to the ground cells in order to maximize overall throughput. After that, we also propose a UE cell selection algorithm, which base on both position information and UE measurement.

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CHAPTER 1

INTRODUCTION

Introduction should provide appropriate context and background for your research, such as the recent trend and importance of the technology development related to your thesis.

CHAPTER 2

BACKGROUND AND RELATED WORK

The goal of this chapter is for laying the technical background (such as distributed source coding) for understanding the contribution of your thesis; non-technical background (such as the background of M2M communications) can go to Chapter 1. Related work should be be classified into proper sub-sections depending on the topics related to your thesis research.

2.1 Satellite Ephemeris

2.2 Related Work

CHAPTER 3

SYSTEM MODEL

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3.1 System Model

In this paper, we consider a LEO satellite communication system. There are N satellites denoted as $\mathcal{N} = \{n \mid n = 1, 2, \ldots, N\}$, and each satellite has M beams denoted as $\mathcal{M} = \{m \mid m = 1, 2, \ldots, M\}$. Satellite beams serve K cells on the ground denoted as $\mathcal{K} = \{k \mid k = 1, 2, \ldots, K\}$. A hexagonal grid of cells is considered.

3.1.1 Signal Model

In the LEO satellite system, the free space path loss defined by 3GPP protocol is as follows [1]:qwereee

$$PL = 32.45 + 20 \log_{10}(f_c) + 20 \log_{10}(d), \tag{3.1}$$

where f_c is the carrier frequency and d is the distance between the satellite and its serving cell position. Also, we introduce the antenna radiation pattern in [2]:

$$G(\theta) = G_{max} \left[\frac{J_1(\mu(\theta))}{2\mu(\theta)} + 36 \frac{J_3(\mu(\theta))}{\mu(\theta)^3} \right]^2, \tag{3.2}$$

where θ represents the angle between the user and the beam center with respect to the satellite, G_{max} is the maximum antenna gain, $\mu(\theta) = 2.07123 \cdot \sin(\theta)/\sin(\theta_{3dB})$, where θ_{3dB} is the 3 dB half-power beamwidth angle of the antenna, and $J_1(\cdot)$ and $J_3(\cdot)$ represent the Bessel functions of the first kind of orders 1 and 3.

$$
\begin{aligned}
\max_{\mathbf{P},\mathbf{a}} \quad & R_{n,m,k}(t) \\
\text{s.t.} \quad & \sum_{m \in \mathcal{M}} P_{n,m}(t) \leq P_{max}, \\
& Q_{n,m,k}(t) \geq \delta, \quad \forall n \in \mathcal{N}, \forall m \in \mathcal{M}, \forall k \in \mathcal{K}, \\
& Q_{\text{tot}}(t) \geq \delta, \\
& C_n(t) \leq \rho, \quad \forall n \in \mathcal{N}, \\
& \sum_{n \in \mathcal{N}} C_n(t) \leq \rho_t, \\
& 0 \leq P_{n,m}(t) \leq P_{\text{beam}}, \quad \forall n \in \mathcal{N}, \forall m \in \mathcal{M}, \\
& 0 \leq \sum_{m \in \mathcal{M}} P_{n,m}(t) \leq P_{\max}, \quad \forall n \in \mathcal{N}.
\end{aligned}
$$

3.2 Problem Formulation

3.3 Satellite Ephemeris

CHAPTER 4

PROPOSED ALGORITHM

CHAPTER 5

PERFORMANCE EVALUATION

All figures should be of the same width whenever possible for consistency.

5.1 Simulation Setup

We use BONMON [**?**] to solve the optimization problem. The simulation setup follows that in [**?**].

5.2 Simulation Results

CHAPTER 6

CONCLUSION AND FUTURE WORK

REFERENCES

[1] 3GPP, "Study on New Radio (NR) to support non-terrestrial networks," 3rd Generation Partnership Project (3GPP), Technical Report TR 38.811, June 2020, version 15.4.0. Online Available at: https://www.3gpp.org/ftp/Specs/archive/38_series/38.811/

[2] S.-H. Chen, L.-H. Shen, K.-T. Feng, L.-L. Yang, and J.-M. Wu, "Energy-efficient joint handover and beam switching scheme for multi-leo networks," in *2024 IEEE 99th Vehicular Technology Conference (VTC2024-Spring)*, 2024, pp. 1–7.