Jakarin Chawachat 2013: Algorithms for Range Queries and Content Delivery Planning for Peer-to-Peer Streaming. Doctor of Engineering (Computer Engineering), Major Field: Computer Engineering, Department of Computer Engineering. Thesis Advisor: Assistant Professor Jittat Fakcharoenphol, Ph.D. 96 pages.

This thesis considers two important problems in Peer-to-Peer streaming. The first part of this thesis considers content delivery planning where peers in the network have diverse uplink bandwidths. The objective of this problem is to find a streaming scheme that minimizes the maximum delivery time from the source to any peers. We consider the special case of this problem where all bandwidths are multiples of the required bandwidth and prove that there exists an optimal solution which is a tree. Using this fact, the problem in this case naturally reduces to the Bounded Degree Minimum Diameter Spanning Tree problem with Non-Uniform Degree Bounds. We propose an algorithm for this problem which is an extension of Könemann *et al.*'s algorithm that works only uniform degree bounds. The solution obtained from our algorithm is a streaming scheme whose delays are at most $O(\sqrt{\log n})$ times the optimal delay where n is the number of nodes in the network.

In the second part, we consider range queries. Peer-to-Peer networks usually employ distributed hash tables to handle data queries. However, hashing destroys the locality property of object keys, the critical properties to range queries. Ganesan *et al.* avoid the hashing approach and introduce a load-balancing algorithm that works with a system that searches directly on the key space. Their algorithm guarantees an imbalance ratio of 4.237 where the imbalance ratio is the ratio between the maximum and minimum load in the network, while using only a constant amortized cost per operation. However, the proposed algorithm is recursive, which is undesirable in practical settings. We present a simpler and non-recursive load-balancing algorithm which guarantees an imbalance ratio of 7.464 with constant amortized costs per operation.

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