論文 / 著書情報
Article / Book Information

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Title(English)	A Routing Table Construction Methodology Based on Routing Table Orders for Structured Overlays
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	数理・計算科学　専攻	申請学位（専攻分野）： Academic Degree Requested	博士　（理学） Doctor of
学生氏名： Student's Name	長尾 洋也	指導教員（主）： Academic Advisor(main)	首藤 一幸
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Structured overlay network algorithms are routing algorithms that construct routing tables whose entries are selected on the basis of logical positions defined in advance. Existing structured overlay algorithms construct desirable routing tables by restricting routing table candidates on the basis of logical positions. The restriction reduces flexibility to cope with a wide range of nodes and a varying number of routing table entries. Moreover, it restricts the ability to extend algorithms because routing table that can be constructed on the basis of a metric other than logical positions are limited.

I propose flexible routing tables (FRT), an algorithm design framework for structured overlay routing algorithms that is designed to achieve the following desirable features: dynamic and arbitrary routing table size and network size adaptability without restricting the candidates for routing tables. FRT-based algorithms are characterized by constructing and maintaining routing tables using two procedures: entry learning and entry filtering. An entry learning procedure adds an entry corresponding to a node to be learned to its routing table. An entry filtering procedure evicts an entry from the routing table according to an order on the routing table space and a sticky entry function. Using these procedures, FRT-based algorithms can construct and maintain routing tables and achieve the desirable features.

I propose FRT-Chord, which is an FRT-based algorithm designed to demonstrate that concrete algorithms can be designed on the basis of FRT. Analyses and experimental results show that FRT-Chord performs as the design of FRT intended. Furthermore, FRT-Chord achieves desirable features derived from FRT such as dynamic and arbitrary routing table size and network size adaptability without restricting routing table candidates. As a result, FRT-Chord can seamlessly transition between the O(1)-hop and multi-hop routing, and its performance is optimized according to the size of routing tables. FRT-Chord repeatedly improves routing tables by the entry learning procedure and the entry filtering procedure, and I prove that the converged routing tables achieve O(log |N|) path length with high probability.

I also propose Grouped FRT-Chord (GFRT-Chord), which is an FRT-based algorithm that extends FRT-Chord to construct routing tables that consider node groups as well as logical positions. GFRT-Chord achieves the reduction of inter-group hops while maintaining short path length derived from FRT-Chord and inherits dynamic and arbitrary routing table size and network size adaptability. This implies that an FRT-based algorithm can be extended to construct routing tables that consider metrics other than logical positions. This ability of FRT-based algorithms is important for real applications where the physical environment must be considered. I prove some desirable properties that result from assigning appropriate priority to node groups. Experimental results show that the path length and the inter-group path length are stably shortened with various patterns of algorithm and network parameters. This means that GFRT-Chord achieves a balance between logical position considerations and node group considerations.

In addition to FRT, I propose mergeable-FRT, an algorithm design framework for real applications that can consider two or more metrics in addition to path length by improving algorithm modularity and reusability. Mergeable-FRT offers a method to merge parts of extensions to mergeable-FRT-based algorithms. This method produces new algorithms that consider multiple metrics, i.e., those considered by the original algorithms (Note that this does not mean that the new algorithms automatically inherit all characteristics of the original algorithms). A mergeable-FRT-based algorithm supports the method to merge with other mergeable-FRT-based algorithms by defining an entry filtering procedure using the sequence of functions. I propose two merged algorithms－PGFRT-Chord and GPFRT-Chord－by reusing implementations of a mergeable-FRT-based GFRT-Chord and PFRT-Chord. Experimental result show that these algorithms reflects the features of the original algorithms.

By proposing these concrete algorithms, I demonstrate the features and abilities derived from FRT. I believe that the FRT frameworks allow us to design new algorithms that are based on various ideas and lead to a systematical design methodology for structured overlay algorithms.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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