

Bubble Grouping for Peer-to-Peer Search

Work-in-Progress

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P2P File-sharing Applications/Systems

Overview

Napster centralized search w/ true p2p file download

Gnutella totally decentralized system

Chord generic *key-value* lookup system

Objectives

- Completely decentralized and scalable system
- Support millions of hosts/nodes
- Support extremely dynamic behaviour of nodes
- Support for very popular keywords (ex: *mp3*)

File Searching Model

To enhance the search capability:

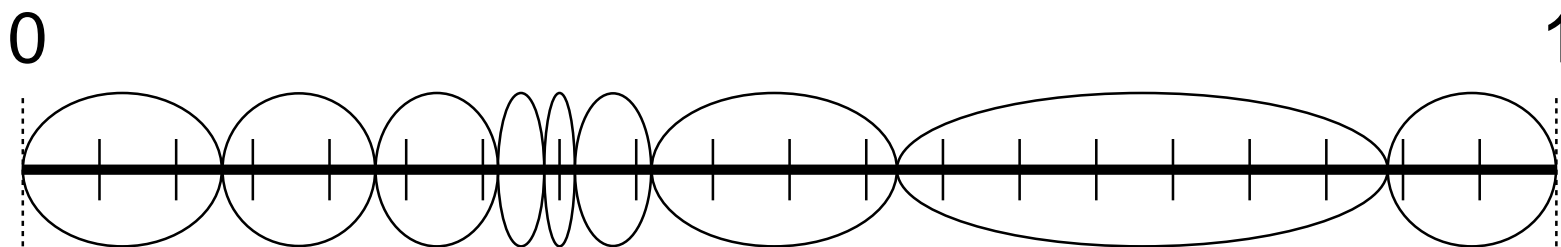
- each file is related to a set of keywords
- a globally distributed index is used

The index stores two kinds of *key* \hookrightarrow *value* pairs:

- *keyword* \hookrightarrow *file hash*_{set}
- *file hash* \hookrightarrow *file location*_{set}

System Structure

- Nodes are grouped into bubbles
- Bubbles contain exclusive parts of the index
- Each index part contains a set of keys and related values



Internal Bubble Structure

- All nodes on the same bubble know about each other
- Each bubble knows it's neighbour bubbles and corresponding nodes
- Bubble data is replicated on all bubble nodes
- Bubble node count ranges between k and $2k$
 k : min hosts required for fault tolerance

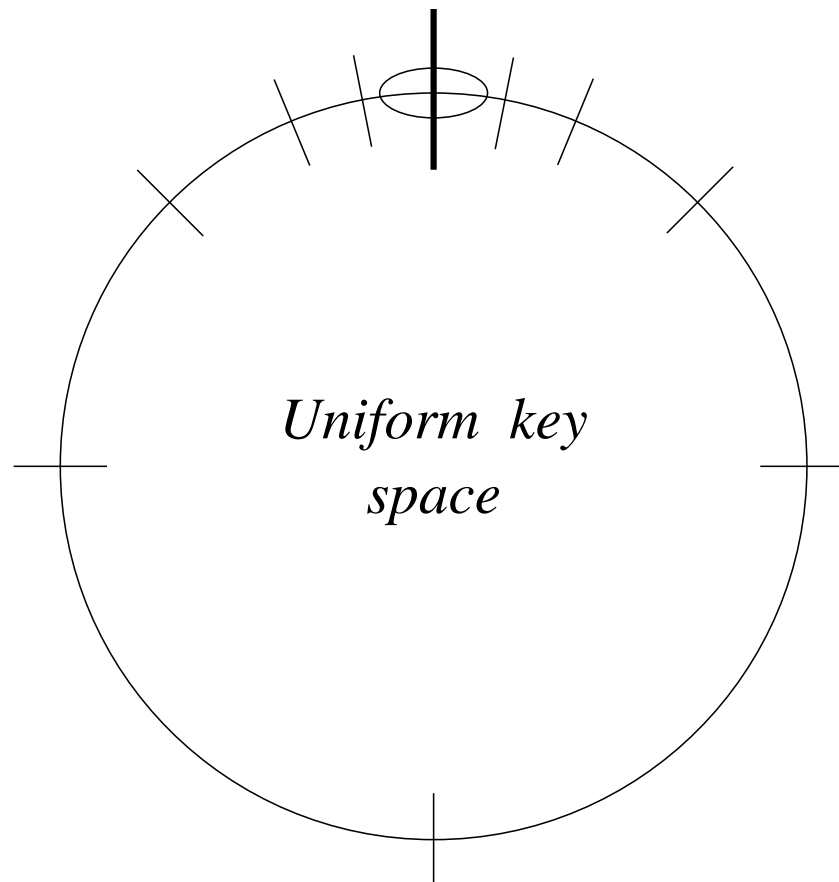
Routing Algorithm

How to find the bubble for a given key?

⇒ Chord algorithm was adapted for efficiency

- Bubbles have routing table with $O(\log N)$ entries
 - lower key distance bubbles have more entries
 - higher key distance bubbles have less entries
- At most $O(\log N)$ steps are required for any keyword

Routing Algorithm



System Operations

- User Oriented:
insert and query
- Node Management:
add and *leave*
- Bubble Management:
split and join

General Behaviour

- Node arrival
forwarded to closest small bubble
- Keyword insertion
- Bubble regrouping
through dynamic management operations
when thresholds are reached
- Temporal Hot-spots

Current Status

Work in progress on:

- System specification/description
- Simulation (static and dynamic)
- Problem of content indexing