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A Secure Method for Routing Queries and Dynamic TTL-Based Search in P2P Networks

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Abstract

The success of these applications is illustrated by systems such as Napster, Emule, Gnutella, and recently, Bit Torrent. In order to ensure the scalability of these solutions many P2P services operate on top of unstructured overlay networks, which are logical networks deployed at the application level. The approach is shown to be stabilizing the query load subject to a grade of service constraint a guarantee that queries' routes meet pre-specified class-based bounds on their associated a priori probability of query resolution. We propose two methods used to improve the search performance in unstructured peer-to-peer networks. The first one is a simple caching mechanism based on resource descriptions. Peers that offer resources send periodic advertisement messages. These messages are stored into a cache and are used for routing requests. The second scheme is a dynamic Time-To-Live (TTL) enabling messages to break their horizon. We show that swap links is the superior random selection approaches: (i) Swap links enables more accurate random selection than does the structured approach in the presence of churn (ii) The structured method is sensitive to a number of hard-to-set tuning knobs that affect performance. Simulation results further show the performance benefits, in terms of mean delay, of the proposed approach. Additional aspects associated with reducing complexity, estimating parameters, and adaptation to class-based query resolution probabilities and traffic loads are studied.

Index Terms: *Overlay, Query resolution, Query Forwarding, Priori probability, Resource discovery and Dynamic-TTL*

1. Introduction

Unstructured networks, by contrast, are easier to setup and maintain, but their mostly ad hoc overlay topologies make realizing efficient searches challenging. In a purely unstructured P2P network [1]. A node only knows its overlay neighbors, with such are the limited information. The inefficiencies of purely unstructured networks can be partially addressed by hybrid P2P systems [2]. Search mechanisms that perform name resolution based on distributed hash table. Although, as will be clear in the sequel, our results are not exclusive to hybrid P2P networks these will serve as the focus of the project. The random nature of the location of query resolution in the network[3]. In pure flooding, a peer sends the query to all its neighbors which, in turn, propagate it to all their own neighbors, and so on. The query starts with an initial Time-To-Live (TTL) which is decreased by one at each hop. It is discarded whenever the resource is found or the message TTL expires [4]. The farthest peers which can be reached with a given TTL are often referred to as the horizon. This approach generates a significant amount of messages [5]. Our objectives through this design are to provide a high success rate for queries while still maintaining a low overhead. The resulting protocol is simple, easy to implement and does not require complex signaling and synchronization between peers [6]. We evaluate our approach, through extensive simulations, in accordance with several performance metrics including the success rate and the search cost [7]. The basic idea in using the item-balancing algorithm in our setting is to assign identifiers in the DHT number space such that a larger portion of the number space maps proportionally into high-capacity nodes, and a smaller portion maps into low-capacity nodes [8].

2. Related Work

Even where uniform random selection is desired, assigning a single random identifier to each node is inadequate because any non-uniformity in the random assignments persists over time [9]. Consistent hashing schemes deal with this by assigning multiple random identifiers and DHTs have proposed something similar, namely creating multiple virtual replicas of each node in the DHT [10]. The message forwarding strategy proposed uses

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feedback from previous searches to probabilistically guide future queries. Similar approaches are proposed on which queries are also forwarded to a set of neighbors according to statistics of previous queries content [11]. Overall several search schemes have been proposed to address the resource discovery issue in unstructured networks. Blind search mechanisms are either not scalable or have a low success rate. Propose an XML based caching approach. XML documents are used to describe resources stored on remote peers and are stored into caches. Searching for a document is performed using flooding and looking in the caches. When a matching document is found, the remote peer is directly contacted, but the flooding continues other mechanisms maintain local information for routing but mostly improve performance for similar queries [12]. Adding super peer can reduce the search cost, at the expense of a lower reliability, as a super-peer can become a single point of failure for its cluster. It also introduces constraints on the topology, increasing the network maintenance cost [13].

3. System Architecture

We propose a generic service that allows nodes to structure themselves in an overlay network of fault-tolerant process groups. The algorithm explores a topology management based on a control approach where constraints are imposed over the neighboring associations among peers to achieve an unique topology [14]. The global connectivity of the overlay is essential not only to potentially ensure the correct operation of P2P services but also to ensure the correct operation of the algorithms employed to maintain the overlay topology despite failures even churn scenarios [15]. This information can later be used to narrow down the number of neighbors to forward the query to and hence find requested resource(s) with a limited number of queries.

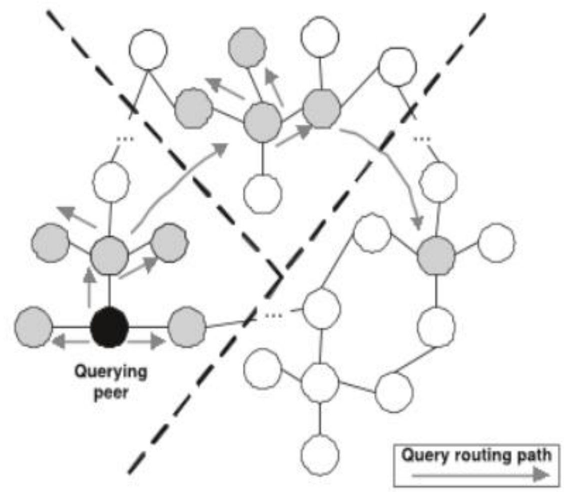

Fig 1 System Architecture

We adopt a dynamic TTL-based approach to increase the probability to find a requested resource. This strategy is used whenever a cached resource description matches a request. It can be viewed as a way to stimulate the query to follow the direction from which the matching advertisement came [16]. We use will the term grant node to refer to a peer that advertises its resources by sending grant messages

4. Proposed System

Given a hybrid P2P topology and query classification, we propose a novel query resolution mechanism which stabilizes the system for all query loads within a ‘capacity region’, i.e., the set of loads for which stability is feasible. Essentially, our policy is a biased random walk• where forwarding decision for each query is based on instantaneous query loads at super-peers [17]. On the other hand, the performance of random walks approaches largely depends on the random choice of walks. we propose a novel query resolution mechanism which stabilizes the system for all query loads within capacity region the set of loads for which stability is feasible. Essentially, our policy is a biased random walk where forwarding decision for each query is based on instantaneous query loads at super-peers. We propose two schemes which can be used to improve the search performance in unstructured peer-to-peer networks. The first one is a simple caching mechanism based on resource descriptions. Peers that offer resources send periodic advertisement messages. These messages are stored into a cache and are used for routing requests. The second scheme is a

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dynamic Time-To-Live (TTL) enabling messages to break their horizon [18]. Additional aspects associated with reducing complexity, estimating parameters, and adaptation to class-based query resolution probabilities and traffic loads are studies .Our approach is fully distributed in that it involves information sharing only amongst neighbors, and achieves stability subject to a Grade of Service (GoS) constraint on query resolution. The GoS constraint corresponds to guaranteeing that each query class follows a route over which it has a reasonable „chance" of being resolved

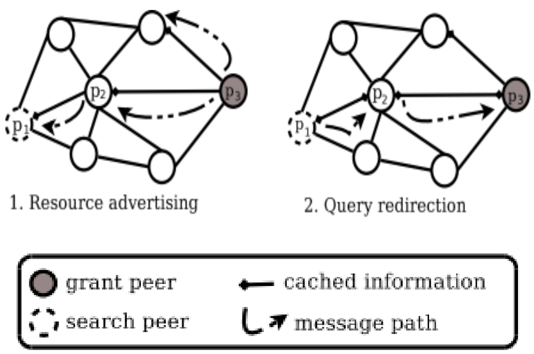

Fig 2 the basic operations of routing approach

A. Dynamic TTL

We adopt two different handling of messages TTL, based on their type. Grant messages TTL are always decremented. Request messages benefit from a slightly different scheme [19]. When receiving a request, a peer will decrement its TTL based on the cache content. Algorithm respectively gives the best neighbor selection and request forwarding process where we use the following notations:

- q(f, n, ttl, R = [r1, r2, ..., rx]) is a request message, looking for [r1, r2, ..., rx] forwarded by peer f and received by node n.
- v is the TTL decrement value.
- N (n) is the neighborhood set of peer n. It is defined as all peers that are located at exactly one hop from n. Through the cache system design and the dynamic TTL, it is possible to forward a request message with a ttl < 1 [20].

Algorithm Dynamic TTL-based forwarding

Require: q(f, n, ttl, R = [r1, r2, ..., rx]), {f, i} ∈ N (n)

BN ← Best Neighbor Selection(N (n), q)

if BN 6= ∅ then

pick up i, such as i ∈ BN

ttl ← ttl − v

send q to i

else

ttl ← ttl − 1

send q to N (n) except f

end if.

We have presented two simple schemes and various routing policies. We believe they can be integrated in existing one. Any search algorithm based on TTL and informed search can be modified to accommodate a dynamic TTL and improve its performance

B. Swap Links Implementation

We use TCP sockets for neighbor connections. Each node sends heart-beat messages to each of its neighbors every neighbor is dead if it does not receive a heart-beat from it time pried. A neighbor discovery walk is reattempted if it fails to return an appropriate neighbor within a period [21]. We currently have an implementation of a rendezvous server that helps new nodes join the system. This rendezvous mechanism is light-weight and makes sure no single node is overloaded with the responsibility of helping new nodes join the network. The rendezvous mechanism could be made more robust by also having the rendezvous server remember a small number of random other nodes in the network, by periodically taking random walks having newly joined nodes report one or two of their neighbors [22].

Every link is an outline in one direction and an in link in the other.
Likewise, there are two types of fixed-length random walks:
Only In Links: The walk is forwarded to a randomly chosen in-neighbor.
Only Out Links: The walk is forwarded to a randomly chosen out-neighbor.
Every node always maintains an out degree of num links, by finding num links out neighbors when it first joins, and by replacing any out-neighbor it loses with another one. This is done in such a way that nodes tend to have the same number of in links and out links, though they may have slightly greater or fewer than num Links in links [23].

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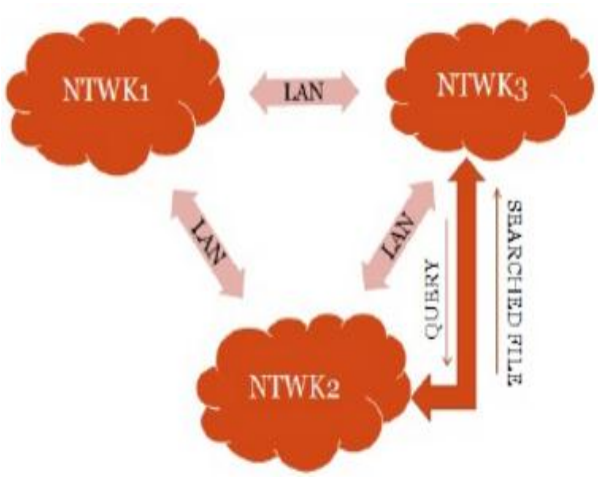

Fig 3Swap Links

5. Performance Results

Performance of Surrogate Queries to study many queries should he reissued in the "Surrogate Queries" algorithm. The setting is similar to the previous one. Note that security is treated as a separate issue in the paper all peer-to-peer networks are vulnerable to various security attacks a peer responds with a 'poisoned file and fakes search results. As expected, both the success rate and the traffic overhead increase with the TTL compared with flooding scheme to achieves the highest success rate and the lowest overhead when the TTL is respectively set to 1, 2, 3. Although the initial success rate is similar when the TTL was set to 4, the traffic overhead generated by DRDP is approximately twice lower than the overhead produced by flooding. The main reason behind this behavior is that the query horizon increases with the TTL value. Overall, the probability of finding a resource provided by the network strongly depends on the chosen TTL value the wider the spreading of the query, the more matches are found and the more traffic is generated. Despite this tradeoff, DRDP approach still slightly affected, in terms of traffic overhead, while increasing the TTL.

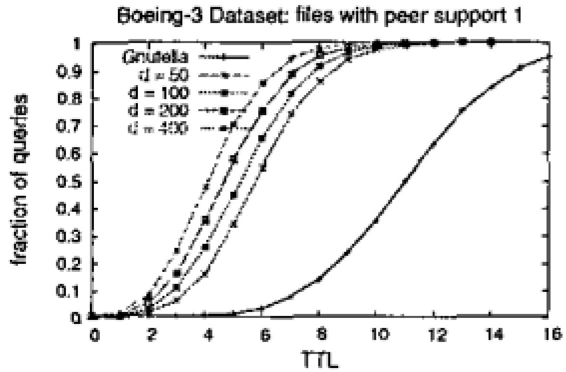

Fig 4 Success Rate

6. Conclusion

We also provide modifications to the algorithm that make it amenable to implement and the sharing content are also to be used to its successful sharing sources from one node to another node file the documents were available the certain file and its including data in the peer to peer networks with calculates the mobility and bandwidth rate of the each node in unstructured peer to peer networks. These caches only store the resource description, not the owner, maintaining a small footprint and allowing aggregation. A dynamic TTL scheme removes the horizon limitation of messages which are more likely to reach a peer providing the needed resource. We are currently exercising Swap links by using it as a basis for a number of P2P applications. The Swap links algorithm is being used in building a toolkit for NAT traversal in P2P applications, and a P2P file backup system. We invite researchers to use our Swap links toolkit in their unstructured P2P applications. In a peer-to-peer system, if you wish more storage space, you need only add another node. Another consequence of this is that such a system quite often has a built-in redundancy. Having files on multiple nodes also distributes the download traffic. Unlike a centralized system where all download requests would go to the central server, in peer-to-peer each download request is passed among peers. Improvements can be appended by changing the existing modules or adding new modules. One important development that can be added to the project in future is secure the data from the External attack and networks also have to connect the network with more unstructured system.

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