Advances in Computer Science and its Applications (ISSN 2166-2924)
Vol. 1, No. 2, June 2012

www.worldsciencepublisher.org

A New Technique for Queries in Unstructured Networks

[1]J.VIJAYA LAKSHMI, [2]T.NAGA ANUJA, [3]Md.YUNUS

1Electronics and Computer Engineering, Koneru Lakshmaiah Colllege of Engineering, Guntur, Andhra Pradesh, India
2 Electronics and Computer Engineering, Koneru Lakshmaiah Colllege of Engineering, Guntur, Andhra Pradesh, India
3 Electronics and Computer Engineering, Koneru Lakshmaiah Colllege of Engineering, Guntur, Andhra Pradesh, India

Email: [1]y8em242@gmail.com, [2]anujasmiles4786@gmail.com, [3]ymohammad40@gmail.com

Abstract. The present peer-to-peer (P2P) content distribution system is based on simple on-demand content discovery technique. This can be improved by implementing additional capabilities namely a mechanism through which peers can register with the network so that they can be continuously informed of new data items, and a means for the peers to advertise their contents. Existing unstructured overlay based systems require complex indexing and routing schemes makes the network less flexible for transient peers. For these applications, we study the alternate continuous query paradigm, which is a best-effort service providing the services. We present a scalable and effective middleware called CQUOS for supporting continuous queries in unstructured overlay networks. CQUOS preserves the simplicity and flexibility of the unstructured P2P network. It has two techniques namely cluster resilient random walk algorithm which is responsible for pro propagating the queries to various regions of the network and dynamic probability-based query registration scheme to ensure that the registrations are well distributed in the overlay. This paper studies the properties of our algorithms through theoretical analysis.

Index Terms: Continuous queries; Transient peers; Random walk; Peer-to-peer networks.

1 INTRODUCTION

The key strength in unstructured P2P networks was its simplicity in designs and their flexibility towards transient nodes. Query searching in these networks is performed by propagating messages in an ad-hoc manner. The current unstructured P2P content distribution systems follows ad hoc query model. One of the limitations is their simple, on demand mechanism for content discovery. In these systems peers find out data by circulating queries within the overlay network. Whenever a query is not found in peer the response was given otherwise the query moves to another peer. Finally when a query finished propagating in the network that query will be deleted from local buffers. This leads to the loss of the query and the query expires .This is ad hoc query model. It has two limitations. One of it is newly added peers may have the data that is needed for the query. But it cannot be identified because the query will not reach the new peer. Assume that the query completes its circulation in the network at time Tc. Clearly, this query cannot discover data items that were added after (Tc+_), where Tc indicates the short duration of time for which the query might be cached at different peers. Further, the query will not reach a peer that joins the network after time Tc, and hence cannot discover matching content on the new peer. In this case, the only way for a peer to identify newly added data items would be issuing same query repeatedly. This is not desirable, since it creates overhead and unnecessary traffic within the network. Second, P2P systems that are purely based on the ad hoc query model provide no support for peers to advertise or announce the data items they own to other interested peers. Advertisements are important for P2P applications where peers trade content. These shortcomings render the ad hoc query model inadequate for many advanced P2P applications. We need a mechanism for the peers to register their long-term interests, and be notified by the system when matching data items are added.

1.1 Paper Contribution

In this paper, we argue that guaranteed notification is not necessary for p2p applications. Instead *best effort notification paradigm* can be used by which the query will be informed by most of the peers.In this paper, we focus on an alternate notification paradigm called the *continuous query model*. his model provides a mechanism through which peers can register their queries, which are maintained in the network for extended durations of time. However, in contrast to traditional pub-sub model, a system implementing the continuous query model provides a best-effort notification service for the registered queries informing their initiating nodes of new content that may have been added in the recent past. Towards addressing these challenges, this paper makes four novel contributions.

First, we present a novel query propagation technique called *Cluster Resilient Random Walk (CRW)* This technique retains the overall framework of the random walk paradigm. However, at each step of propagation, CRW favors neighbors that are more likely to send messages deeper into the network thereby enabling the continuous queries to reach different topological regions of the overlay network.

Second, a *dynamic probability scheme* is proposed for enabling the recipients of a continuous query to make independent decisions on whether to register the query. In this scheme, a *query* that has not been registered in the past several hops has a higher chance of getting registered in its next hop, which ensures that registrations are well distributed along the path of a query message.

2 THE COQUOS SYSTEM

In this section, we present a high-level description of the CoQUOS system architecture. We begin by introducing a few concepts that are used in the rest of the paper.

Two peers Pi and Pj are said to be *neighbors* of each other if there exists a link Lv = (Pi; Pj) connecting them. The network is dynamic with peers entering and leaving the network. New links may be established in the network and existing links torn down. We assume that each data item Dr in the system has associated metadata (represented as MData(Dr)) that describes it. Continuous query is the means through which a peer can register its long term interests with the Co- QUOS system. A continuous query, represented as Q = (SID; Predicate; V Time), is essentially a tuple of three components, namely, *source ID* (SID) , *query predicate* (Predicate) and *validity time* (V Time).

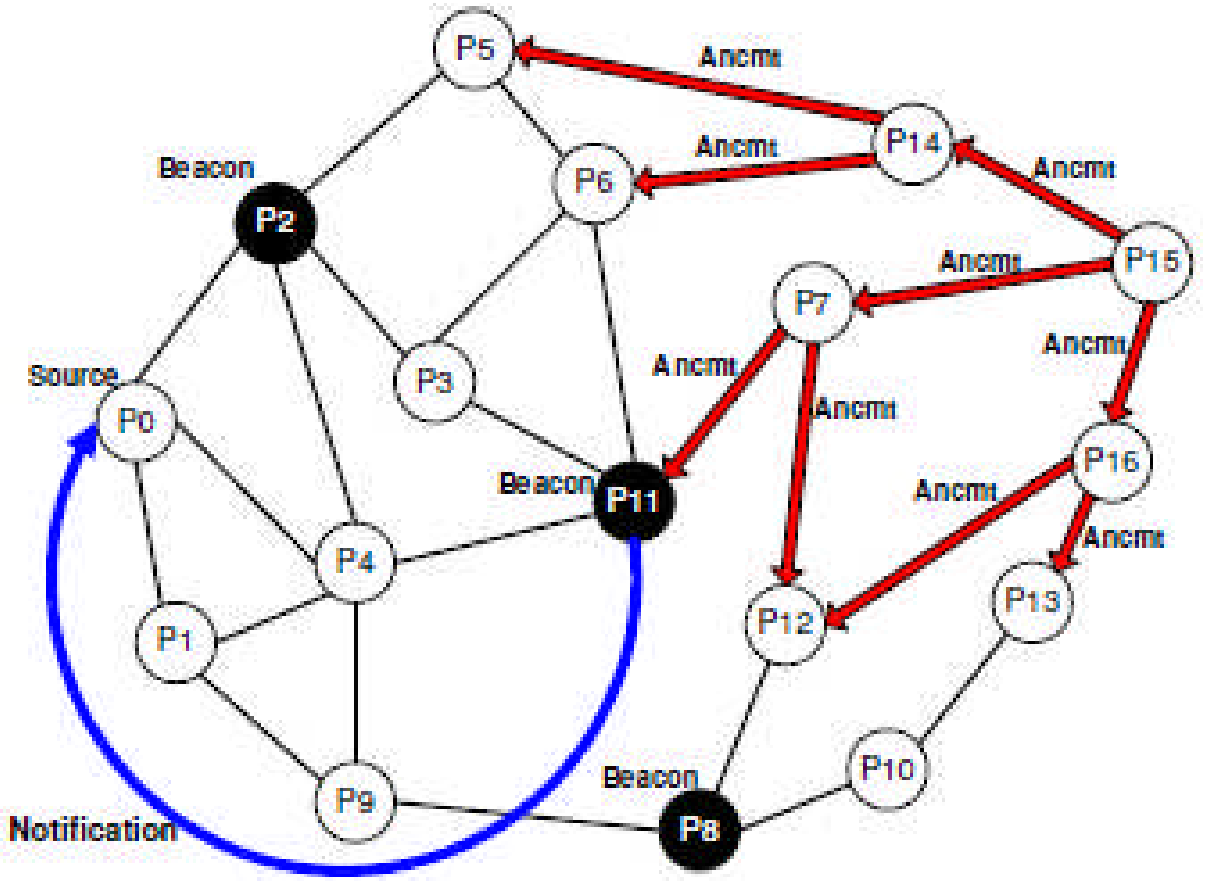

Fig. 1. CoQUOS System Overview

The source ID uniquely identifies the peer issuing the query. The query predicate is the matching condition of the query, and is used by the source peer to specify its interests. In general, the predicate can be of any form such as range predicates or even a regular expression. We assume that the predicate is a list of keywords describing the content the source peer is interested in. Validity time (V Time) represents the time until which the source node is interested in receiving notifications. Peers announce their new data items through *announcements*. An announcement is represented as Ad = (AID;MData). The *announcing peer ID* (AID) identifies the advertising peer and the metadata (MData) is the metadata of the content being advertised. A data item Dr (and analogously its announcement) is said to *match* a continuous query Qm, if Dr's metadata contains *all* the keywords in Qm's predicate.

2.1 Design Overview

Our goal in designing the CoQUOS system is to design a highly effective notification service on top of arbitrary unstructured overlay networks. A common way of quantifying notification effectiveness is through the overall notification success rate of the system. However, our design of the CoQUOS middleware strives for a stronger notion of notification effectiveness, wherein the goal is not only to achieve high overall success rate, but also reasonably high success rates for each individual query. Our system works essentially by maintaining each continuous query at one or more peers of the overlay. If a continuous query Qm is registered at a peer Pi, then Pi is called the *beacon node* of the query Qm. A peer that registers a query implicitly agrees to assume the responsibility of notifying the source node of any matching data items that it might discover. Beacon nodes discover new data through incoming peer announcements. When a peer Pi receives an announcement message, it checks all the queries that are registered to see if any of the queries match the received announcement. Upon finding a matching query Qi, Pi sends a notification to Qi's source node. In addition, beacon nodes can take more pro-active roles, and they may periodically circulate the registered queries in their close vicinity to search for new data items. In this paper, however, we only consider peer announcement-based data item discovery by beacon nodes. In the current design, the announcements are circulated through a Gnutella-like broadcast scheme [1]. However, in order to ensure that the communication overheads of the system are small, the TTL of the announcement messages are set to very low values. Specifically, a peer that needs to announce a new data item, creates an announcement message with corresponding keywords, sets the TTL to a pre-specified value (Announcement TTL) and sends the message to all its neighbors. The recipients of the message decrement the TTL and send it to their neighbors. This process is repeated until the TTL reaches zero. Thus, an announcement essentially reaches the set of nodes that are within a small number of hops from the peer issuing it. We are currently exploring advanced strategies such as iterative deepening and directed breadth first search for further reducing the announcement message load. Figure 1 illustrates the functioning of CoQUOS middleware. Peers fP2; P8; P11g are the beacon nodes of a continuous query issued by P0. The node P15 issues an announcement that matches the query. The TTL of the announcement is set to 2. This announcement reaches the beacon node P11, which notifies P0. A source peer may receive multiple notifications for the same advertisement, in which case it ignores all but the first notification.

3 Cluster Resilient Random Walk

Flooding-based broadcast is an option for circulating continuous queries. However, this would be analogous to a breadth first traversal of the network. As previous studies have reported, in this scheme, messages remain in close vicinity of the source node and do not go deep into the network. Random walk is another message propagation paradigm that has received considerable attention from the P2P research community. In the context of P2P networks, random walk works as follows: When a peer node Pi receives a message whose TTL has not expired, it selects one of its neighbors completely at random and forwards the message to that peer. Since, at each step the message is forwarded to only one neighbor, the message load imposed by random walk is very low. Random walk corresponds to a depth-first traversal of the network, and a message propagated through random walks has a higher probability of reaching remote regions of the network than its flooding-based counterpart. In this paper we use the terms random walk and pure random walk (PRW) interchangeably. The above property of the random walk makes it an attractive paradigm for propagating continuous queries. Unfortunately, the random walk protocol suffers from one significant drawback that undermines its utility or propagating queries in the CoQUOS system. Prior studies have shown that the ability of random walk in propagating messages to remote topological regions diminishes significantly on overlay networks that exhibit significant degrees of node clustering . In these networks there are distinct clusters of nodes with large numbers of connections among them, whereas the connections _owing across clusters are comparatively small in number. For these networks, the random walk protocol suffers from the following drawback. When a message enters a cluster, it is likely to keep circulating within the cluster for large number of hops before exiting the cluster. Thus, the message *spends* a significant fraction of its TTL before reaching a different topological region of the overlay. In Figure 2, a random walk message that reaches peer P4 has a high probability of visiting majority of the other peers in P4's cluster (i.e., peers fP0; P1; P2; P3g), possibly multiple times, before going to other regions of the network. In other words, the message gets *trapped* in the cluster for considerable number of hops thereby adversely affecting its ability to reach remote regions of the overlay. Towards overcoming the above drawback, we have designed a novel query dissemination scheme called *cluster resilient random walk* (CRW). This scheme is motivated by a crucial observation: *Two peers belonging to the same cluster generally have large numbers of common neighbors*. Thus, a peer Pj has a lesser likelihood of being in the cluster of another peer Pi, if a large fraction of Pj's neighboring peers are not neighbors of Pi. Based on this observation, the CRW scheme forwards messages to *out of-cluster* nodes with high probability, thereby mitigating the possibility of messages getting trapped in clusters. In this scheme, a peer computes the overlap between its neighbor list and those of each of its neighbors, and uses this information while making message forwarding decisions. A peer that has little overlap has higher probability of receiving the query in the next hop, and vice-versa.

4 Dynamic Probability Based Query Registration

Each peer receiving a query message can decide register it with a certain fixed probability, say Rp. We call this scheme the *fixed* probability-*based query registration scheme (FP scheme, for short)* . Although this strategy seems intuitive, it cannot guarantee high notification success rates for every query. The reason is that for some continuous queries a long series of peers in the path of the query message may all decide not to register the query, whereas another sequence of consecutive nodes may all decide to host the query. The announcements originated near the *dry patches* of a query's path might fail to reach any of its beacon nodes, thus leading to low success rates. Considering these requirements, we have designed a novel *dynamic probability*-based technique *(DP scheme, for short)* for peers to decide whether to register a continuous query. As in the fixed probability scheme, a peer receiving a query-message registers it with certain probability. However, the registration probability of a query varies as the query traverses along its route. The central idea of the dynamic probability scheme can be summarized as follows:

The probability of registering a query at a peer node would be high if the query has not been registered at the nodes it visited in the recent past. In contrast, if the query has been registered at a node that visited in the past few hops, the probability of it getting registered at the current peer would be low.

Specifically, the scheme works as follows. Each continuous query message Qm is associated with a value called *registration probability* (Rp(Qm)). The registration probability of a query message indicates the probability that it would be registered at the peer it visits next. When a peer issues a query, the registration probability is set to an initial value (called *initial probability*). When a peer Pi receives a query message Qm, it registers the query with probability Rp(Qm). If Pi registers the query, it also resets the value of Rp(Qm) to the default initial value, before forwarding the message to one of its neighbors. On the other hand, if Pi decides not to register the query, it increments Rp(Qm) by a pre-determined amount (called *probability increment*) before forwarding the query to one of its neighbors. Thus, the registration probability value associated with a query message keeps increasing until it gets registered at a peer, at which point it falls suddenly to the default initial value. The number of beacon nodes of a query can be controlled through the initial probability and probability increment parameters. Higher values of these parameters result in larger number of subscriptions and vice-versa. Experiments show that our decentralized beacon node selection scheme comprising of CRW and the DP query registration scheme, not only yields significant improvement in the overall success rates, but also ensures reasonably high individual success rates for all queries.

5 CONCLUSIONS

We presented the design and evaluation of a lightweight system, called CoQUOS. The CoQUOS middleware is a completely decentralized scheme to register a query at different regions of the P2P network. The CoQUOS has many new features such as cluster resilient random walk for query propagation, dynamic probability scheme for query registration. The proposed techniques have been evaluated through theoretical analysis [23-26].

REFERENCES

[1] S. Androutsellis-Theotokis and D. Spinellis. A Survey of Peerto- Peer Content Distribution Technologies. *ACM Comput. Surv*., 2004.
[2] B. Arai, G. Das, D. Gunopulos, and V. Kalogeraki. Approximating Aggregation Queries in Peer-to-Peer Networks. In *Proceedings of the* 22nd *International Conference on Data Engineering (ICDE)*, 2006.
[3] R. Baldoni, C. Marchetti, A. Virgillito, and R. Vitenberg. Contentbased Publish-Subscribe over Structured Overlay Networks. In *Proceedings of ICDCS* , 2005.
[4] G. Banavar, T. Chandra, B. Mukherjee, J. Nagarajarao, R. E. Strom, and D. C. Sturman. An Ef_cient Multicast Protocol for Content- Based Publish-Subscribe Systems. In *Proceedings of ICDCS 1999*, 1999.
[5]Gnutella PPNetwork. www.gnutella.com.
[6] Kazaa P2P Network. www.kazaa.com.
[7] TIB/Rendezvous. White paper, 1999.
[8] T. Bu and D. F. Towsley. On Distinguishing between Internet Power Law Topology Generators. In *INFOCOM*, 2002.
[9] A. Carzaniga, D. S. Rosenblum, and A. L. Wolf. Design and evaluation of a wide-area event noti_cation service. *ACM Transactions on Computer Systems*, 19(3):332.383, 2001.
[10] Y. Chawathe, S. Ratnasamy, L. Breslau, N. Lanham, and S. Shenker. Making Gnutella-like P2P Systems Scalable. In *Proceedings of ACM SIGCOMM 2003*, 2003.
[11] J. Chen, L. Ramaswamy, and A. Meka. Message Diffusion in Unstructured Overlay Networks. In *Proceedings of NCA*, 2007.
[12] P. Chirita, S. Idreos, M. Koubarakis, and W. Nejdl. Publish/ Subscribe for RDF-based P2P Networks. In *Proceedings of the 1st European Semantic Web Symposium*, May 2004.
[13] P. A. Chirita, S. Idreos, M. Koubarakis, and W. Nejdl. Designing Semantic Pub-lish/Subscribe Networks using Super-Peers. *Semantic Web and Peer-to-Peer.Springer Verlag*, 2005.
[14] P. T. Eugster, R. Guerraoui, and C. H. Damm. On Objects and Events. In *Proceedings of OOPSLA*, 2001.
[15] P. T. P. Felber, R. Guerraoui, and A.-M. Kermarrec. The Many Faces of Publish/Subscribe. *ACM Computing Surveys*, 35(2), 2003.
[16] P. Ganesan, M. Bawa, and H. Garcia-Molina. Online Balancing of Range-Partitioned Data with Applications to Peer-to-Peer Systems. In *Proceedings of VLDB*, 2004.
[17] B. Gedik and L. Liu. A Scalable Peer-to-Peer Architecture for Distributed Information Monitoring Applications. *IEEE Transaction on Computers*, 54(6), 2005.
[18] C. Gkantsidis, M. Mihail, and A. Saberi. Random Walks in Peerto-Peer Networks. In *Proceedings of the IEEE INFOCOM 2004*, 2004.
[19] C. Gkantsidis, M. Mihail, and A. Saberi. Hybrid search schemes for unstructured peer-to-peer networks. In *INFOCOM*, 2005.
[20] A. Gupta, O. D. Sahin, D. Agrawal, and A. E. Abbadi. Meghdoot: content-based publish/subscribe over P2P networks. In *Middleware 2004*, 2004.
[21] V. Kalogeraki, D. Gunopoulos, and D. Zeinalipour-Yazti. A Local Search Mechanism for Peer-to-Peer Networks. In *Proceedings of CIKM*, 2002.
[22] J. Kannan, B. Yang, S. Shenker, P. Sharma, S. Banerjee, S. Basu, and S.-J. Lee. SmartSeer: Using a DHT to Process Continuous Queries Over Peer-to-Peer Networks. In *Proceedings of IEEE INFOCOM*,2006. 2002.
[23] Yudong Zhang, Lenan Wu, Rigid Image Registration by PSOSQP Algorithm, Advances in Digital Multimedia, 1(1), pp. 4-8, 2012
[24] Tejaswi Lalitha Surepeddi, K. Gowtham, A. Ramakrishna, D. Aruna Kumari, Design, Implementation of Network Based Authentication Mechanisms, Advances in Information Technology and Management, 1(2), pp. 44-48, 2012
[25] M.Venkateswara Rao, Narasimha Rao Medhari, Power Optimization for On-Chip Communication architectures in MPSoC, Advances in Information Technology and Management, 1(2), pp. 49-59, 2012
[26] Xiao-Jun Yang, A short introduction to Yang-Laplace Transforms in fractal space, Advances in Information Technology and Management, 1(2), pp. 38-43, 2012