

# BROKER-BASED ARCHITECTURE FOR ADVERTISEMENT PROPAGATION IN P2P NETWORKS

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This paper considers advertisements exchanged in peer-to-peer networks. The nodes searching for a given resource send *purchase advertisements*, and nodes sharing their resources with others send *sale advertisements*. Locating a resource on the network then consist in matching purchase advertisements with sale advertisements. The architecture described here is based on brokers, which are nodes specialized in matching advertisements.

## 1 Introduction

A peer-to-peer (P2P) network can be considered as a system allowing its nodes to locate resources owned by other nodes. Some of these systems, like Napster [1], are using for that purpose a central server that contains a global index of the resources. Other systems, like Gnutella [1], are completely distributed, meaning that no server is required. In this case, resource location is done by propagating *search message* from neighbour to neighbour in the network, and matching, in each node, the search message against the resources owned by this node. *Reply messages* can be sent back to the source of the search, to notify that a match has occurred.

One consider from now the search message to be like a *purchase advertisement* for a given resource. Peers willing to share their resources theb propagate *sale advertisement*. Thus, the matching between purchase advertisement and sale advertisement does not anymore need to take place inside the peer owning the resource.

## 2 Brokers

*Brokers* [2] are defined as peers that are willing to share their processing resource with the members of the network in order to match sale advertisement and purchase advertisement. Normal peers can however still match purchase advertisements they receive and propagate against their own resources.

In P2P systems using either a central index (e.g. Napster) or several decentralized partial indexes (e.g. KaZaA or eDonkey), the equivalent of sale advertisements are gathered by one or several nodes which have a special status in the

network (in Napster and eDonkey, they are called *servers* and are not acting as peers; in KaZaA they are called *supernodes*, and have the possibility to act also as normal peers). For better performance in searching resources, nodes should have a direct connection to at least one broker.

### **3 Purchase Advertisements**

In the previous systems, purchase advertisements have a short lifetime: if they are not matched against sale advertisements, they are removed from the system because they have proven useless. In case the resource that was searched for is only temporarily unavailable, the search yields no result, or even false positives (in server-based systems) if the server's index is not up-to-date with the network (this has been observed quite often in large networks, where synchronization between the server's index and the peers cannot be maintained in real time). The originator of the search then has to re-send a search message at a later time, hoping for the resource to be then available again.

Storing purchase advertisements by the brokers would prevent repeating the search messages and thus save bandwidth on the network and avoid false-positives. In addition, sale advertisements must contain an expiration date, which will prevent advertisements to be available when the resource they describe has become unavailable, and prevent the broker's memory to overload with advertisements which are out-of-date. Once an advertisement has expired, the owner of the resource must issue a new advertisement that replaces the older one. In the same way, purchase advertisements must have a limited life-time (chosen by the broker that is storing it) depending e.g. on its memory capacity.

### **4 Locating a Broker**

The functionality of being a broker is also a resource available on the network. Sale advertisement would be sent within a purchase advertisement targeted to brokers. This will at the same time ensure that the advertisement will either reach a broker or will at least be propagated to other peers which might be interested in it, and that a broker is searched, for the peer to later directly connect to it.

### **References**

- [1] Andy Oram, editor. *Peer-to-Peer: Harnessing the Power of Disruptive Technologies*. O'Reilly & Associates, Inc., 1st edition, March 2001.
- [2] Oscar Arturo Ribeiro and Matthieu Weber. *P2P Advertisements - Specification*. University of Jyväskylä/Agora Center, June 2003.