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Disseminate Personalized Information Efficiently Using Content Based Multicasting (CBM)

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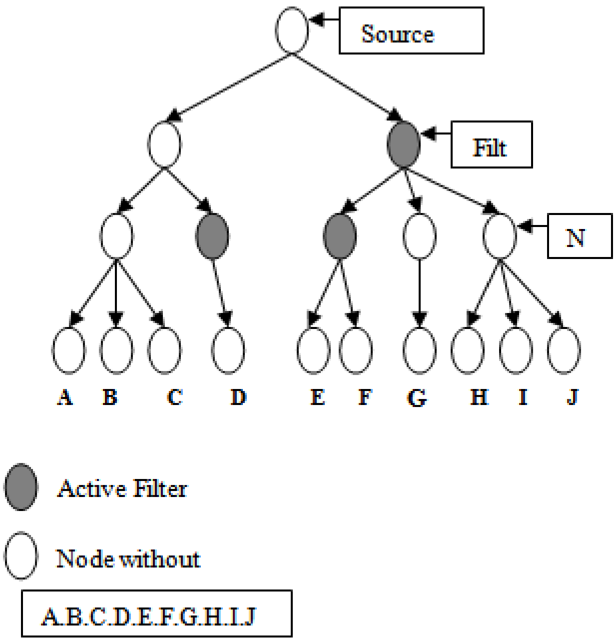
ABSTRACT: There has been a surge of interest in the delivery of personalized information to users, particularly as mobile users with limited terminal device capabilities increasingly desire updated and targeted information in real time. Traditional IP multicast services do not consider the structure and semantics of the information. This paper proposes the use of Content-Based Multicast (CBM) where extra content filtering is performed. The benefits of CBM depend critically upon how well filters are placed at interior nodes of the IP multicast tree and considers the benefits of allowing the filters to be mobile, so as to respond to user mobility.

I. INTRODUCTION

Future information systems will increasingly need to deliver the results of diverse applications to a growing number of users. Basic IP multicast consists of a set of participants, one of whom is typically the source whereas the others are sinks. The basic traditional multicast does not concern itself with the content or structure of the information being delivered. Using basic multicast, the source has a limited set of options. On the other hand, if fewer groups are used, the recipient has to filter out a large amount of unnecessary information and network bandwidth is utilized inefficiently.

CBM takes into account the structure and semantics of the information being disseminated and attempts to minimize both network utilization as well as recipient processing by intelligently filtering the information as it propagates towards each recipient. The information is disseminated using IP multicast. This paper considers a solution where the filtering is done by means of filters, which can potentially be mobile, residing at the intermediate nodes in the network, either in IP or application level routers or at attached CBM servers. A filter can then apply complex criteria and ensure that information propagates down the tree to a child only if a user at a leaf in that child's subtree desires the information. As users move or change their filtering criteria, or as the information being disseminated changes, filters may move from one interior node to another in response. Example: The IP multicast tree illustrated in below in figure 1 demonstrates the benefits of CBM.

Each user (labeled A-F) requests some subset of items (from 1-12). These subscriptions propagate up the tree. Interior nodes are labeled with the union of the subscriptions from the leaves in their subtree. The source sends the 12 items of information requested by at least one recipient. With basic unicast to each user, the total traffic is 183 units. With basic IP multicast, all 12 items are sent on all 15 links, resulting in 180 units of total traffic. Each recipient then must filter out all undesired items. If filters are placed at every interior node of the tree, the traffic can be reduced to 141 units, and the recipients need not perform any filtering. Recognizing, however, that filters themselves represent a cost, suppose we restrict the number of filters and place them at the shaded interior nodes. Then, the total traffic is reduced to 145, and some recipients (B, C) must perform filtering, while others (A, D-F) need not.



N→ NEWS S → STOCK W → WEATHER

Subscription Details

A→	N	F →	N,S
B→	S	G→	N,S
C→	W	H→	N,S
D→	S	I→	N,S
E→	N	J→	N,S

Fig.1 Example of decreased bandwidth utilization with three filters (shaded vertices). The value on each edge denotes the traffic flow in the presence of filters.

CBM is increasingly important as the quantity and diversity of information being disseminated in information systems and networks like the Internet increases, and users suffering from information overload desire personalized information. In addition, CBM is increasingly important as wireless networks (ad hoc networks, multihop packet radio networks, wireless LANs, and wide-area cellular networks) proliferate, since wireless bandwidth is scarce and resources (in terms of computation, storage and battery life) in wireless devices are limited.

II. MATRERIALS & METHODOLOGOES

Subscription and Matching Algorithms

Minimizing Total Traffic with K Filters

An algorithm is developed for finding a filter placement on a given IP multicast tree that minimizes the total bandwidth consumption for a given set of subscriptions, assuming that the required flow values are provided at each vertex. Observe that filters cause overhead in terms of processing and delay since they are assumed to act above the network layer. This overhead is accounted by imposing the limitation that at most k filters may be placed within the multicast tree. That is, for the resulting filter placement , |P|<= k.

Optimal Algorithm for Placing k Agents in Binary Tree: As shown in figure:3, for a vertex v belongs to V, let L (v) and R (v) denotes the left and right child of v, respectively. Let the Lowest Tight Ancestor (LTA) of v, denoted as A(v), to be the lowest ancestor of v whose parent has a filter or the root if no ancestor has a filter. For the root, A(w) = w. Some observations regarding LTA, First, observe that if the parent of v has a filter, then A(v) = v. Similarly, if v_1…., v_j are siblings, then A(v_1)= =A(v_j). Finally, note that if u is the parent of v and u does not have a filter, then A(u)=(v).

Let T(v,i,p) denote the minimum total traffic in Tree(v) given that up to i filters can be placed in Tree(v) and the LTA of v is A(v)= p. Thus, the objective function is to minimize T (w, k, w), where w is the root of M. The total traffic can be expressed by the following recurrence relations where, for notational convenience, it is set L (v) = l, R(v) = r, A(v) = p.

If v is a leaf, then T (v, i, p) = 0 for all p, i.

Otherwise,T(v,i,p)=min{f(l)+f(r)+$\min_{0<=j<}$ {T(l, j, i)+T(r, i-j-1, r)}(We should place a filter at v);

2f (p)+$\min_{0<=j<=i}$ {T (l, j, p) + T(r, i-j,P)} (We should not place a filter at v). }

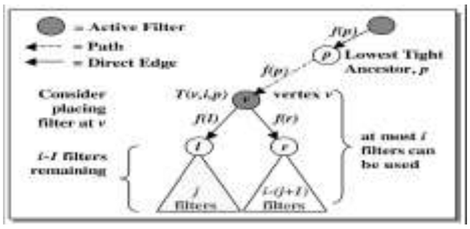


Fig.3 Filter placement to minimize total traffic. The incoming flow to v would be equal to the subscription set size of its Lowest Tight Ancestor. If i filters are remaining and a filter is placed at vertex v, then the subtrees rooted at v can only have i - 1 filters allocated among them.

Heuristic for Filter Placement: It is desirable to have filter placements calculated rapidly so that the source can quickly respond to changes in user subscriptions. Also, when user subscriptions change, the optimal algorithm may require many of the k filters to move. Since filter mobility has a cost, it is to be restricted in some way. The filter placement heuristic runs in essentially the same framework as the optimal algorithm, with the exception that the heuristic takes into account not only that filters have costs, but that moving a filter has a cost. Thus, while the optimal algorithms calculate a new filter placement for each batch, where potentially the positions of all filters may change, in the heuristic allows only one filter to be moved for each batch, which can be described as 3 steps: 1. Importance flip 2. Parent-child flip 3. If neither flip would reduce traffic, the heuristic does nothing. Since the heuristic can only move one filter at a time, whereas the optimal can move them all, it is expected that the heuristic would perform well for a small number of filters.

III. HOW IT WORKS

The source in the multicast tree periodically receives information to be disseminated. The root is the source and the leaves are the recipients. For CBM, the software modules, called filters, are distributed at the interior nodes of this multicast tree. The filters reside at filter platforms, which can be IP routers, or at servers attached to the local subnet of a router.

Filter Placement Algorithm Framework :A filter placement on a multicast tree M =(V,E) with vertex set V and edge set E subset of VxV is a set P which is a subset of V , where filters are placed at all vertices in P and on no other vertex in V . Let |V|=n. The root of M is denoted w and Tree(v) denotes the subtree rooted at vertex v belongs to V. Thus, Tree (w)= M. All the filter placement algorithms operate in the CBM framework as shown in the following figure.

Content-Based Multicast Framework**(M)** **{**/* M=(V,E) is the model of the multicast tree */

B={b(u); **u** is a leaf of **M}**, where **b(u)** is the set of items requested by user **u.**

Repeat every time period{

1. Batch new subscription requests **b'** & cancellations **c'** into **B'= {b(u) U b'(u)\c'(u)};**
2. Calculate new incoming flow **f(v)** required at each vertex **v belongs V** based on **B';**

/* Find new filter placement */

3. Let **P=**FilterPlacement**(M,f,P)**;
4. Issue instructions to enact the new placement **P;} }**

Fig : 2 Pseudocode for implementing the CBM framework.

Users may make or modify their subscriptions and these subscriptions propagate up the tree to the source in accordance with the subscription algorithm. The source collects the requests periodically into batches. At the end of each period, the source runs the filter placement algorithm and calculates a new filter placement. It then sends signaling messages to the filters in the tree to activate, passive, migrate, or spawn filters as necessary. The source then multicasts information which is the union of the subscriptions in the current batch.

IV. COMPARISION WITH EXISTING SYSTEMS

Traditional IP Multicasting: Traditional or basic IP multicast consists of a set of participants, one of whom is typically the source whereas the others are sinks. Any information generated by the source is delivered to the group by setting a multicast tree.

Drawbacks-Traditional Multicasting: The basic traditional multicast does not concern itself with the content or structure of the information being delivered. Using basic multicast, the source has a limited set of options. On the other hand, if fewer groups are used, the recipient has to filter out a large amount of unnecessary information and network bandwidth is utilized inefficiently. The limitations of basic IP multicast become much more severe once the recipients desire more complex filtering and personalization, and especially if the information being delivered is unstructured or has limited metadata.

Advantages of Content Based Multicasting :CBM takes into account the structure and semantics of the information being disseminated and attempts to minimize both network utilization as well as recipient processing by intelligently filtering the information as it propagates towards each recipient. The filtering is done by means of filters, which can potentially be mobile, residing at the intermediate nodes in the network. A filter can then apply complex criteria and ensure that information propagates down the tree to a child only if a user at a leaf in that child's subtree desires the information. As users move or change their filtering criteria, filters may move from one interior node to another in response

V. CONCLUSION

In this paper, the effect of using mobile filters are considered for achieving personalized delivery using the paradigm of content-based multicast. Personalized information delivery has become an important and lucrative application-level service. CBM is also applicable to other important facilities such as event subscription and notification. However, the effectiveness of CBM depends upon the placement of the filters and their movement in response to changes in user subscriptions and motion. An optimal algorithm for placement of filters to minimize total traffic that runs in time proportional to the square of the number of vertices in the multicast tree is described. Then a simple heuristic that runs in linear time but which is suboptimal is described. The efficient heuristic performed very close to the optimal algorithm for both small and large number of filters.

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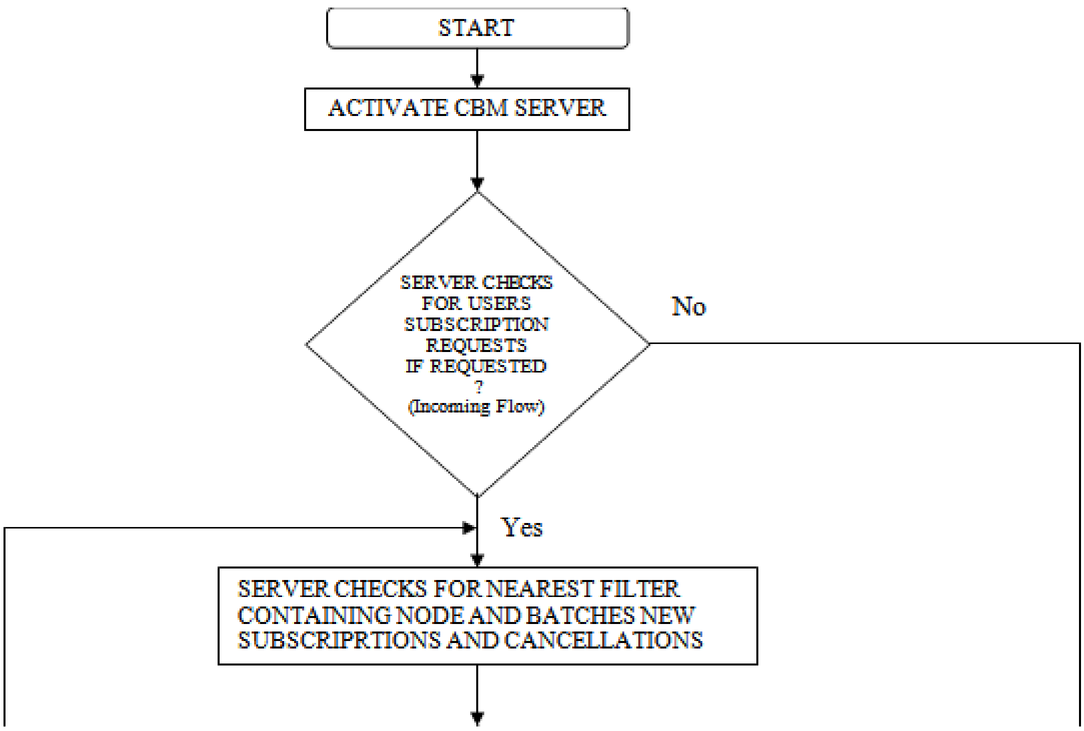

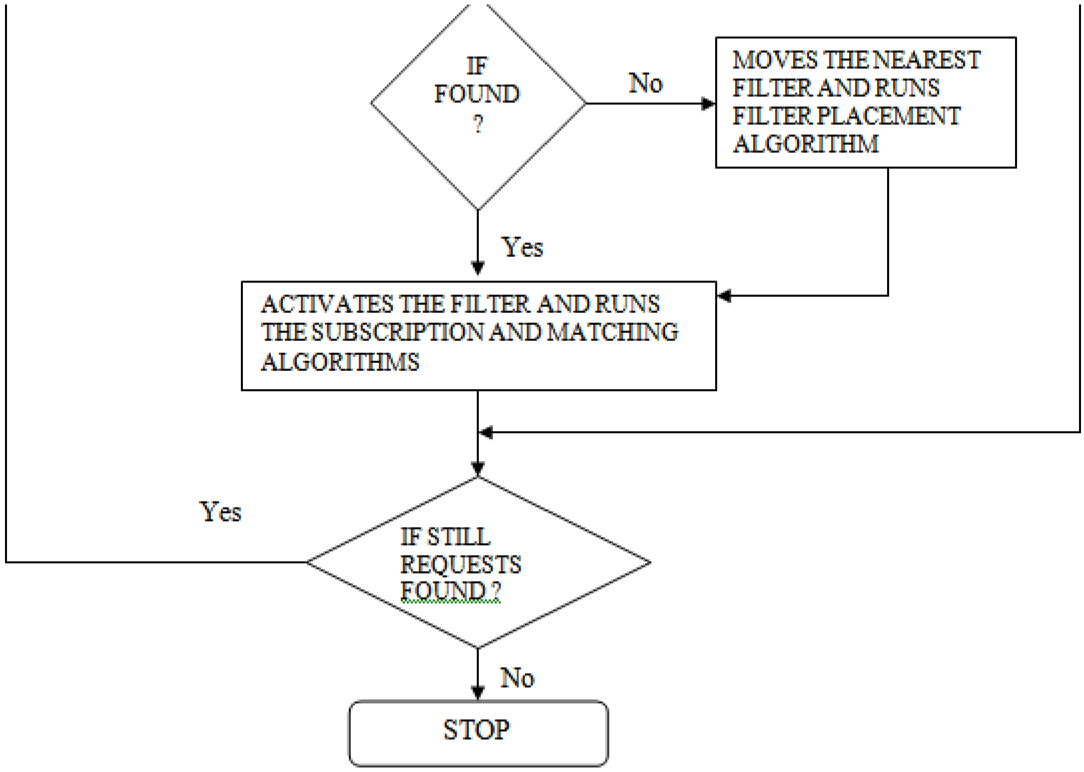
IF FOUND ?
No
MOVES THE NEAREST FILTER AND RUNS FILTER PLACEMENT ALGORITHM
Yes
ACTIVATES THE FILTER AND RUNS THE SUBSCRIPTION AND MATCHING ALGORITHMS
Yes
IF STILL REQUESTS FOUND ?
No
STOP

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