ADHOC Networks Improving Power Efficiency using Multicast Multi-Path Routing Technology

Prianka R. R, Bibin M. R, Saravanan, Sivnthiram

Abstract- The proposal of this paper presents a measurement-based routing algorithm to load balance intra domain traffic along multiple paths for multiple multicast sources. Multiple paths are established using application-layer overlaying. The proposed algorithm is able to converge under different network models, where each model reflects a different set of assumptions about the multicasting capabilities of the network. The algorithm is derived from simultaneous perturbation stochastic approximation and relies only on noisy estimates from measurements. Simulation results are presented to demonstrate the additional benefits obtained by incrementally increasing the multicasting capabilities. The main application of mobile ad hoc network is in emergency rescue operations and battlefields. This paper addresses the problem of power awareness routing to increase lifetime of overall network. Since nodes in mobile ad hoc network can move randomly, the topology may change arbitrarily and frequently at unpredictable times. Transmission and reception parameters may also impact the topology. Therefore it is very difficult to find and maintain an optimal power aware route. In this work a scheme has been proposed to maximize the network lifetime and minimizes the power consumption during the source to destination route establishment. The proposed work is aimed to provide efficient power aware routing considering real and non real time data transfer.

Key words: - Consumption, Lifetime, Perturbation, Stochastic

I. INTRODUCTION

Multicast traffic over the Internet is growing steadily with increasing number of demanding applications including Internet broadcasting, video conferences, data stream applications and web-content distributions [1]. Many of these applications require certain rate guarantees, and demand that the network be utilized more efficiently than with current approaches to satisfy the rate requirements. Traffic mapping (load balancing) is one particular method to carry out traffic engineering, which deals with the problem of assigning the traffic load onto pre-established paths to meet certain requirements. Our focus is to scrutinize the effects of load balancing the multicast traffic in an intra domain network.The proposal in this paper presented a distributed optimal routing algorithm to balance the load along multiple paths for multiple multicast sessions. Our measurement-based algorithm does not assume the existence of the gradient of an analytical cost function and is inspired by the unicast routing algorithm based on Simultaneous Perturbation Stochastic Approximation (SPSA).

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The measurement-based routing algorithm [13] to load balance intra domain traffic along multiple paths for multiple multicast sources. Multiple paths are established using application-layer overlaying. The proposed algorithm is able to converge under different network models, where each model reflects a different set of assumptions about the multicasting capabilities of the network. The algorithm is derived from simultaneous perturbation stochastic approximation and relies only on noisy estimates from measurements. Simulation results are presented to demonstrate the additional benefits obtained by incrementally increasing the multicasting capabilities.

II. MULTIPATH MULTICASTING

The proposed scheme is multicast video in multiple paths over wireless networks. It consists of two parts. The first part is to split the video into multiple parts and transmit each part in a different path. In the latter part, employ multicast method to transmit the video packets to all the nodes. In this scheme, we assume that the network is lightly loaded, i.e., mobility and poor channel condition rather than congestion are major reasons for packet drop.

2.1 Route Discovery

The first criterion in wireless medium is to discover the available routes and establish them before transmitting. The selection of path for data transmission is done based on the availability of the nodes in the region using the ad-hoc on demand distance vector routing algorithm. By using the Ad hoc on Demand Distance Vector routing protocol, the routes are created on demand, i.e. only when a route is needed for which there. In order to facilitate determination of the freshness of routing information, AODV maintains the time since when an entry has been last utilized. A routing table entry is “expired” after a certain predetermined threshold of time. Consider all the nodes to be in the position. Now the shortest path is to be determined by implementing the Ad hoc on Demand Distance Vector routing protocol in the wireless simulation environment for periodically sending the messages to the neighbours and the shortest path.

2.2 Route Maintenance

The next step is the maintenance of these routes which is equally important. The source has to continuously monitor the position of the nodes to make sure the data is being carried through the path to the destination without loss. In any case, if the position of the nodes change and the source doesn’t make a note of it then the packets will be lost and eventually have to be resent.

2.3 Data Transmission

The path selection, maintenance and data transmission are consecutive process which happen in split seconds in real-time transmission.

Hence the paths allocated priory is used for data transmission. The first path allocated previously is now used for data transmission. The data is transferred through the highlighted path. The second path selected is now used for data transmission. The data is transferred through the highlighted path. The third path selected is used for data transmission. The data is transferred through the highlighted path.

III. MULTIPATH MULTICASTING USING POWER

Algorithm

Since a MANET may consist of nodes which are not able to be re-charged in an expected time period, energy conservation is crucial to maintaining the life-time of such a node. In networks consisting of these nodes, where it is impossible to replenish the nodes' power, techniques for energy-efficient routing as well as efficient data dissemination between nodes is crucial. An energy-efficient mechanism for unipath routing in sensor networks called directed diffusion has been proposed. Directed diffusion is an on-demand routing approach. In directed diffusion, a (sensing) node which has data to send periodically broadcasts it. When nodes receive data, they send a reinforcement message to a pre-selected neighbour which indicates that it desires to receive more data from this selected neighbour. A multipath routing technique which uses braided multipaths is also proposed. Braided multipaths relax the requirement for node disjoint. Multiple paths in a braid are only partially disjoint from each other and are not completely node-disjoint. These paths are usually shorter than node disjoint multipaths and thus consume less energy resources; alternate paths should consume an amount of energy comparable to the primary path. A simple localized technique for constructing braids is as follows. Base layer (BL) packets are sent along path 2, while enhancement layer (EL) packers and retransmitted BL packets are sent along Path 1. A source sends out primary path reinforcement to its (primary path) neighbor as well as alternate path reinforcements to its (alternate path) neighbors. Each node in the network performs this same neighbor and path selection process. The evaluation of the performance of the proposed energy constrained algorithms is a function of the overall goal of minimizing energy resources. In the system, the source maintains multiple paths to the destination and reserves bandwidth along the paths such that the total bandwidth falls within an acceptable range. The total number of paths is not necessarily equal to the number of streams. Therefore, a path may carry packets from different streams. Similarly, packets from one stream may be allocated to different paths. The task of the source is to allocate the packets from each stream among the paths such that a minimum level of quality can be observed at the receiver. Depending on the path conditions and application requirements, the source chooses to use multiple-description coding or layered coding. The source coder also must adjust the rate allocation to each stream depending on the available bandwidth. Using intelligent path selection and traffic allocation along with adaptive source coding, the system can adapt well to fluctuating network conditions caused by path failures or changes in available bandwidth.

IV. EXPERIMENTAL EVALUATION OF POWER AWARE MULTI-PATH MULTICASTING

In localized proposed algorithms, the nodes in the network make routing decisions based solely on the location of itself, the location of the destination and the location of its neighbors. Localized algorithms are distributed algorithms where simple local node behavior achieves a desired global objective [12]. Non-localized algorithms are those in which the nodes require the complete knowledge of all the nodes in the network along with the corresponding edges. In ad hoc mobile networks, nodes are moving at all times and there may be several nodes exiting and entering the network at any given point of time. To keep a track of all these nodes and their corresponding edges is cumbersome and requires a huge overhead. To avoid this overhead, routing decisions are made on demand using the dynamic source routing technique.

4.1 Existing Power Aware Metrics and Routing Algorithms

There are number of power and cost aware metrics present. The two basic ones are Power aware routing. In this case, the transmission power depends on the distance between the source and the destination. Cost aware routing: In this case, the routing decisions are made based on the remaining life-time of nodes between the source and the destination.

4.2 Proposed Power Aware Algorithm

The proposed algorithm and the parameters considered for conducting this experiment extend the power-cost efficient algorithm to implement timing constraints. The results of the power-cost aware algorithm show that it performs better when the network/graph is dense. In a large network, a node will have a large number of neighbors. The computation time for calculating the minimum power-cost among the nodes' neighbors is quadratic or exponential (depending on the algorithm used, power+cost or power*cost). In order to reduce this computational time we introduce a threshold value for the remaining battery power of the nodes.

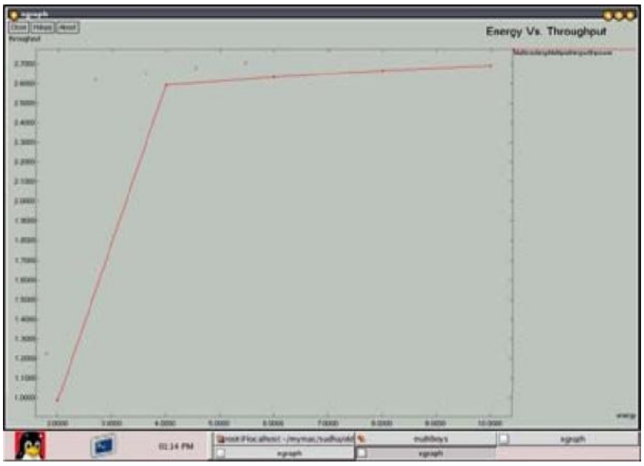
The modified proposed algorithm

Threshold = 50%; success = 0; cutoff = 10%
A := S;
Repeat
If g(A) >= hreshold then
B := A;
Let A be neighbor of B that minimizes
pc(B,A) = power -cost(B,A) + v(s)f'(A);
Send message to A;
success = 1;
Until A = D (* Destination reached *)
or if success <> 1 then
if threshold > cutoff then
threshold = threshold /2;
or A = B (* Delivery failed *);

V. RESULT ANALYSIS MULTI-PATH MULTICAST

Power Model

Experiments are conducted with the intra domain network topology. It is a close approximation to analyze how our routing algorithm performs under these conditions since; recent findings suggest that many ISPs are in the process of increasing the node connectivity of their networks. Each link has a bandwidth of 20 Mbps. The topology has 3 sources that simultaneously send multicast traffic, where each source has 18 receivers and nodes 10 and 23 are selected as additional overlay nodes. Each source-destination pair has three paths including the min-hop path starting at the source node and each source generates Poisson traffic with an average rate of 10 Mbps. The routing algorithm starts from the setting that all overlay rates other than the source nodes are set to model, the algorithm starts with basic unicast routing to reach each destination.

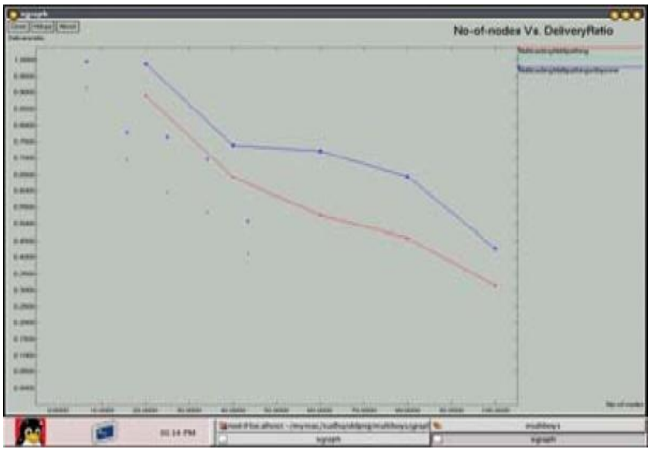


Graph 1: Energy Vs Throughput for Multi-Path Multicast Data Delivery

In this proposed method the video can be split into five parts and transmitted in multipath based on the availability of the nodes. The source and the destination for the transmission are visible. The five paths taken are shown below.

Path 1: 0-10-15-17-13-21-24
Path 2: 0-1-4-19-24
Path 3: 0-10-20-3-21-24
Path 4: 0-1-18-6-19-24
Path 5: 0-2-16-12-7-22-24

Throughput is the amount of digital data per time unit that is delivered over a physical or logical link, or that is passing through a certain network node. Delivery Ratio = (Number of Packets Received) / (Number of packets Sent) Delay is defined as the average time taken by the packet to reach the server node from the client node. Delay = (Number of packets Received) / (Simulation Time)



Graph 2: Number of Nodes Vs Delivery Ratio for Multi-Path Multicast Transmission

VI. CONCLUSION

The proposed power aware multicast identifies the characteristics of the proposed routing algorithm. It evaluates its performance under various network conditions. Each plot presented illustrates the average of 10 independent runs that are initiated with different random seeds. For the optimization algorithm, the link cost function is selected, and defined. In all simulations, the period of link state measurements is selected as one second. As a consequence, source nodes can update their rates at best approximately every two seconds since it require two measurements for estimating the gradient vector according to the modified power algorithm. For simplicity set the rate of redundancy due to source coding, to zero. The optimal values suggest that the complexity of having smart routers that are able to forward packets onto each branch at a different rate offers only a marginal benefit in this scenario. However, it is hard to draw any further conclusions as this result may depend on the specific topology and source-destination pair selections. Also, our algorithm does better than tradition power algorithm as a consequence of the availability of multiple trees to distribute the traffic load. However, while under network topology model the algorithm is able to minimize the cost to a certain level, it cannot eliminate the packet losses and has a much higher overall cost compared to traditional ones. The reason behind this result is the lack of multicast functionality. Since we cannot create multicast trees, the only savings due to multicasting occurs between the sources and overlay nodes.

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