AN ENERGY CREATIVE FLOODING SYSTEM IN MOBILE AD-HOC NETWORKS

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Abstract— Along with the most energy-intensive operations in mobile ad-hoc networks is the network-wide packet broadcasting known as flooding, which although highly inefficient is broadly employed by routing protocols to distribute link/node state information or route-discovery requests. Among the schemes introduced to limit this inefficiency and improve network scalability, Multi-Point Relaying (MPR) stands out as one of the most flexible, applicable to both proactive and reactive routing approaches. However, its original design based on fixed-power broadcast-mode transmission, precludes it from benefiting unicast (including directional-antenna) and variable-power transmission environments. We propose a family of MPR-based protocols for such environments, and present a matter-of-fact evaluation of their energy-conserving capabilities based on simulation models that employ the same code base used in actual network nodes and accurate radio models based on the specifications of existing transceivers.

1.INTRODUCTION

opportunity Army operations will progressively more rely on networked data achievement and communication on the battlefield. Among other requirements for resourcefulness and survivability, mobile communication devices for the battlefield must be lightweight, inexpensive, and easy to maintain. Such devices' power sources are a major hurdle in meeting these requirements and since major improvements in battery technology are not expected in the near future , energy-efficient operation becomes dominant in constraining battery dimensions and refill needs.

This is just as important for the soldiers in minimizing their load, as it is for unattended systems such as sensors and robots that must remain operational without recharging for prolonged time periods. Although, many routing protocols that minimize the energy consumed for multi-hop packet delivery have been deliberate, most of them astonishingly rely on flooding as a mechanism for disseminating or discovering network state information. Flooding, although simple and effective, can be quite inefficient particularly in dynamic environments such as the battlefield.

1.1. SIMULATION MODELS

once some consideration regarding a significant way of putting System, Model, and Simulation in an appropriate perspective I arrived at the following distinction.

System - A system exists and operates in time and space.

Model - A model is a simplified representation of a system at some particular point in time or space intended to promote understanding of the real system.

Simulation - A simulation is the manipulation of a model in such a way that it operates on time or space to compress it, thus enabling one to perceive the interactions that would not otherwise be apparent because of their separation in time or space.

The simulation models used in this study employ the networking protocols used in actual network nodes developed for programs such as JTRS and FCS infrastructure, the difference being that the replicated nodes exchange packets via OPNET radio models, which have also been designed following the exact specifi-cations of the real transceivers.

Another difference is that although the link-layer protocols are capable of estimating the transmission power required to close a link based on the power of received packets, the simulated nodes are provided with the exact instantaneous link transmission power to simplify this study. All simulation results presented are averaged over 3, 300-second trials of random-waypoint node laydowns.

1.2. MULTI-POINT RELAYING

An improvement over the efficiency of flooding has been offered by Multi-Point Relaying (MPR) (Qayyum, et al. 2002), as part of the Optimized Link-State Routing Protocol (Clausen, et al. 2001).

In MPR flood packets are retransmitted only by nodes that are designated as relays, selected to limit redundant retransmissions. Ideally, such transmissions should be minimized by selecting the nodes of the connected dominating set of the network graph as relays. However, identifying this set is a difficult task, requiring global knowledge of the network graph and being computationally an NP-complete problem.

To circumvent these problems, MPR operates only with the network state of a node's 2-hop neighborhood and employs a heuristic algorithm based on a greedy strategy of preferentially selecting the most connected nodes for relays.

This strategy assumes that: (1) flood packets are broadcast, reaching all 1-hop neighbors simultaneously and (2) transmissions are performed at a single power level. Consequently, it is incompatible with unicast (including directional-antenna) transmission and unable to effectively exploit the energy-conserving potential of variable-power transmission.

2. CONVEY SELECTION ALGORTIHMS

We propose a family of relay selection algorithms, applicable to both unicast and broadcast transmission, that account for the variable energy required to reach different nodes. For unicast transmission environments we propose two protocols: MPR-S(elective)U(nicast) and MPR-M(inimum)E(nergy). Our brief protocol description follows , where all lines represent existing connections. The thick

Arrows show the minimum-energy spanning tree constructed by the Least Unicast Cost algorithm (Weiselthier, et al. 2000) that superimposes the minimum-cost paths from the source (node 1) to each destination, along which tree MPR-ME transmits flood packets.

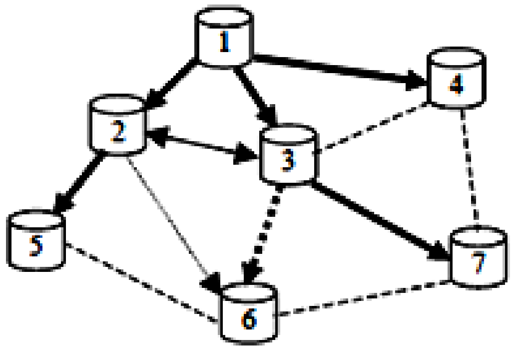
The thin arrows represent the superfluous transmissions that would be performed when classical MPR is applied (recall that MPR selects as relays the most connected nodes that reach all 2-hop neighbors, e.g. nodes 2 and 3). Finally, MPR-SU is a unicast- but not energy-aware extension of MPR that additionally removes any overlapping transmissions; in the figure, the dotted arrows show transmission that are preformed "in reverse" by MPR-SU, 2→6 instead of MPR-ME's 3→6.

It should be noted that the proposed protocols differ in the relay-notification overhead they generate. Once a node has identified its 2-hop multicast tree it must inform its 1-hop neighbors whether and if so, where to forward the flood packets that it sends them. MPR features the buck overhead, since it only switches relay status on or off, whereas MPR-SU and MPR-ME need to specify a list of the 2-hop nodes associated with each relay. Ideally, the trade-off between notification overhead and relay optimality should be controlled to achieve maximal efficiency, which remains a problem for future work.

They propose a family of MPR-based protocols for such environments, and present a realistic evaluation of their energy-conserving capabilities based on simulation models that employ the same code base used in actual network nodes and accurate radio models based on the specifications of existing transceivers.

In Figures, we present the energy expenditure for dissemination of Link-State Updates (LSUs) for a 24-node random network with a varying number of moving nodes (speed 2 m/s), i.e., varying update intensity. MPR-ME achieves appreciable energy savings in the range of 8-31% with a notably increasing trend as flooding intensifies. MPR-ME clearly outperforms classical MPR, except for 1 moving node, where LSU volume is so low that its reduction is insufficient to compensate for the additional overhead generated by MPR-ME. MPR-SU's poor performance across all trials is also a result of its higher overhead not being compensated by a commen-surate flood reduction due to its over-simplistic heuristic.

All three protocols display no deterioration of user packet delivery, indicating no loss of routing information.



Two-hop neighborhood illustration

We introduce the principle of flow conservation over an ideal static and dynamic model network model:

· Let a_i be a node such that $a_j \in A$, where $A = \{a_1, a_2, a_3 \ldots a_N\}$ is the set of all nodes in the network, N is the total number of nodes in the network, and $j = 1, 2, 3 \ldots N$.

· Let b_j be the subset of nodes in the network which are neighbors of a_j, i.e. b_j is the neighborhood of a_j. It follows that $a_j \notin b_j$ and also $b_j \subset A$.

· Let Δt be the period of time elapsed between two points in time t_0 and t_1 such that
$\Delta t = t_1 - t_0$.

· Let T_{ij} be the number of packets that node a_i has successfully sent to node a_j for a_j to forward to a further node; $a_i \in b_j, a_j \in b_i, i \neq j$ and $T_{ij}(t_0) = 0$.

· Let Rij be the number of packets that node a_i has successfully received from node a_j that did not originate at a_j; $a_i \in b_j, a_j \in A_i, i \neq j$ and $R_{ij}(t_0) = 0$.

Algorithm:

Step(I): Allocate as such as possible to variable a_{ij} ,North West Corner Method of the area.

Step(II) Adjust the associated nodes of root and neighborhood by subtracting the allocated distance.

Step(III) If all nodes have been allocated

Stops.

Else if minimal distance in root node a_i is satisfied AND the neighbors node is satisfied. [Remove either root node or neighbors node]

Else if the supply in root node a_i satisfied remove root node a_i.

Else if the neighbors node a_j is satisfied remove neighbors node a_j.

Goto Step(i)

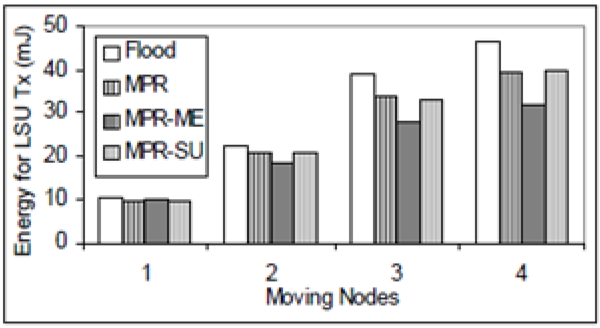


Figure : Energy consumption for LSU flooding, Unicast mode (24-node network)

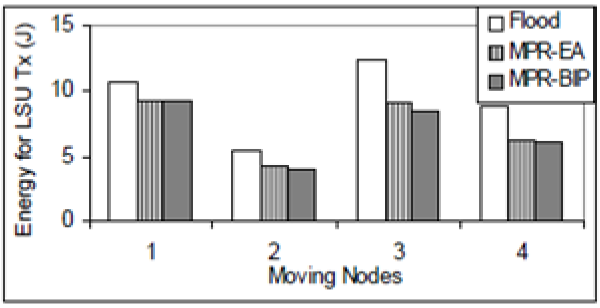


Figure : Energy consumption for LSU flooding, Broadcast mode (24-node network)

In broadcast mode, constructing a minimum-energy spanning tree becomes NP-hard, thus we employ the Broadcast Incremental Power (BIP) heuristic algorithm that provides near-optimal solutions (Weiselthier, et al. 2000). To make a fair comparison, we also enhance MPRwith the ability to reduce transmission power to the level necessary to reach the farthest relay (MPR-EA). Even so, MPR-BIP clearly outperforms it, resulting in energy savings of 26-33%, without any detrimental side effects

3. CONCLUSIONS

In the paper, we present a relatives of energy-conserving flooding protocols capable of supporting both immediate and practical steering approaches, as well as network applications that rely on flooding. Based on sensible simulation models, these protocols show significant energy-conserving potential. opportunity effort will focus on methods for balancing the protocols' overhead and relay optimality to further enhance their efficiency

Today wireless technologies are frequently used transversely the world to hold up the communication needs of a huge number of end users. The significance of wireless technologies in daily life has been discussed. In this paper, we have discussed about the wireless ad hoc networks and we introduced an algorithm for Proficient Data Broadcast Technique which is help full for reducing data replica as well as try to improve the over all performance of the network.On the other hand we have seen that Wireless Network are highly vulnerable to attacks due to their characteristics that have been discussed in this thesis. The research work that has been done to secure the Wireless Networks and various background concepts related to our work are also studied. Here, we discuss about the work that has been reported in this thesis.

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