Reliable Broadcast Scheme Initiated by Receiver In Ad Hoc Networks

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Abstract

In mobile ad hoc network, every link is wireless and every node is mobile. Those features make data lost easily as well as broadcasting inefficient and unreliable. Moreover, efficiency and reliability is conflicting each other. Hence it is hard to achieve both at a time with just one scheme. In this paper, we present the scheme to improve the reliability and efficiency of the broadcast protocol in mobile ad hoc network. This scheme, unlike flooding which keeps reliability by sending excessive redundant packets, improves delivery rate with minimum overhead without degrading efficiency.

1. Introduction

In this paper, we focus on the problem of sending broadcast data packet reliably and efficiently in a mobile ad hoc network. Especially, when more than one nodes try to broadcast a packet at the same time, the reliability of the broadcast is degraded seriously since packets originated from different sources can meet at the same middle nodes in broadcasting path. To prevent reliability dropping under multi sources broadcasting, a new mechanism is required to support reliability without deteriorating efficiency.

2. Related Works

The simplest broadcast mechanism is Flooding in which a source sends a packet to all its neighbors and each of those neighbors in turn rebroadcasts the packet exactly one time. The redundant packets in flooding consume bandwidth and degrade network efficiency seriously [5]. In order to improve broadcast's inefficiency, AHBP [2] gathers the local topology knowledge by exchanging Hello message periodically. AHBP permits the only relayers selected by the source to forward the broadcast packet to its one-hop neighbor. The other nodes except relayers can't forward the packet. In AHBP, selecting relayers among its one-hop neighbor minimizes the number of redundant packet, but on the other hand, packet loss impact in efficiency is tremendous and single packet loss degrades broadcasting reliability seriously

3. Scheme to Improve Reliability

Broadcasting from a source in mobile ad hoc network proceeds by intermediate node's relaying. Hence overall broadcast reliability can be improved if a sender or a relayer detects a packet loss and retransmits it in one hop. For each sender to identify the passing packet, our mechanism uses relayer broadcast sequence number (RBS). Every relayer in mobile ad hoc network manages its own RBS and increases its RBS whenever a node sends or relays the broadcast packet. While broadcast packet is being distributed, RBS in broadcast packet is constantly changed to relayer's RBS as shown in Figure 1.

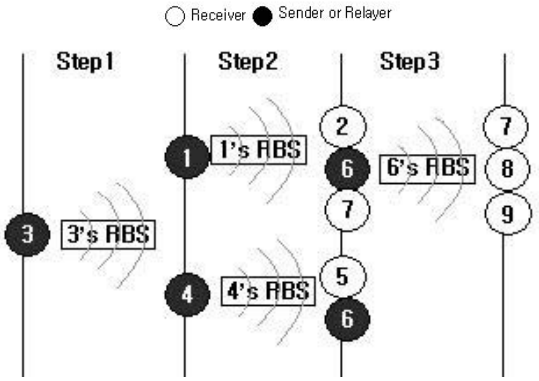

Figure 1. RBS update in broadcasting

In our mechanism, the receiver detects the lost packet identified by RBS. When receiver gets the packet, it compares the broadcast packet' current RBS with previous RBS in the previous packet from the same originator. If the difference between the previous packet's RBS and current packet's RBS is bigger than one, receiver sends NACK by piggybacking lost packet's RBS in Hello message. Because Hello message is exchanged periodically, NACK can be delivered with small additional bandwidth. When a source or a relayer receives the packet loss notification piggybacked in Hello, it should retransmit the packet.

Proceedings of the 28th Annual IEEE International Conference on Local Computer Networks (LCN'03)
0742-1303/03 $ 17.00 © 2003 IEEE

4. Simulation Results

We apply our mechanism to AHBP that achieves efficiency by minimizing redundant packet number. We evaluate efficiency and reliability by exhaustive simulations using the Network Simulator 2 (ns2).

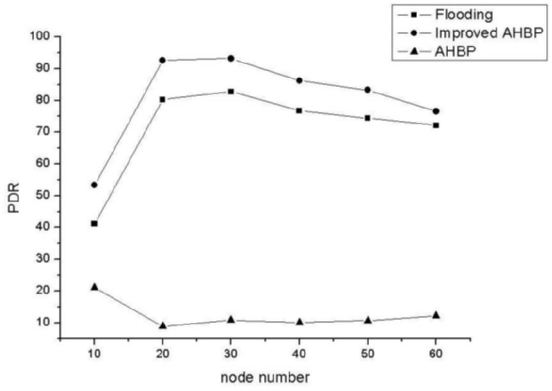

Figure 2. PDR with multi-sources scenario

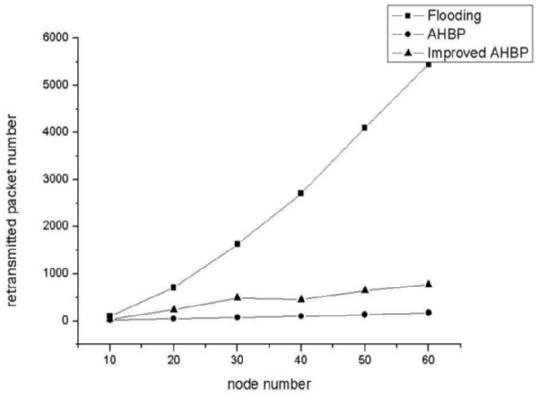

Figure 3 Retransmitted packet # with multi-source scenario

Figure 2 shows packet delivery rate (PDR) with changing the node number under multi-source. Improved AHBP, AHBP which our mechanism applies, shows our mechanism' reliability is as high as Flooding by contrast with AHBP. Moreover, Improved AHBP consumes bandwidth much lower than Flooding as shown in Figure 3. We can conclude that our mechanism achieves reliability with small overhead.

To evaluate scalability, we measure PDR and retransmitted packet number increasing multi-source number in proportion to total node number. Figure 4 shows the PDR with changing of source number rate w (source # of nodes / total # of nodes). The PDR of improved AHBP doesn't degrade despite multi-source rate increases. Bandwidth consumption also doesn't increases in spite of increases in multi-source rate.

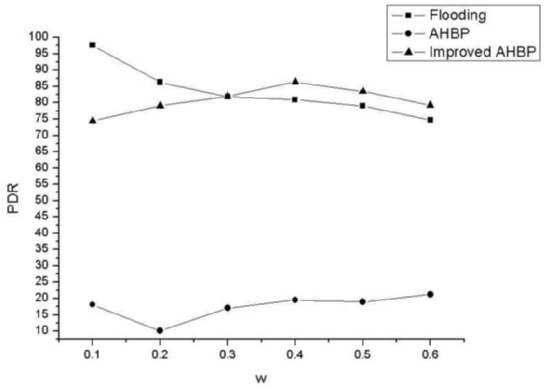

Figure 4. PDR when multi-source rate changes

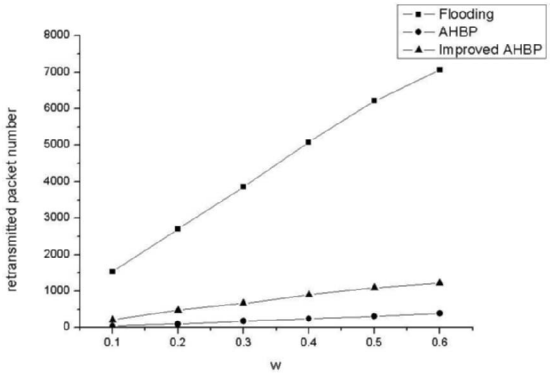

Figure 5 . Retransmitted packet # changing multi-source rate

5. Conclusion

Less does broadcasting mechanism consumes, more efficient broadcasting mechanism become. But minimizing redundant packet increase single packet loss impact, mechanism to improve reliability is required. We improve broadcast reliability by confirming the broadcast packet reception based on NACK scheme using RBS. and our mechanism achieves as high reliability as Flooding with small overhead.

6. References

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