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Adaptive Congestion Control status for mobile ad-hoc network

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Abstract

Routing protocols for mobile ad hoc networks (MANETs) have been explored extensively in last few years. Much of this work is targeted at finding a feasible route from a source to a destination without considering current network traffic or application requirements. Routing may let a congestion happen which is detected by congestion control, but dealing with congestion in reactive manner results in longer delay, and unnecessary packet loss and requires significant overhead if a new route is needed. Routing should not be aware of, but also be adaptive to, network congestion. Adaptation to the congestion helps to increase both the effectiveness and efficiency of routing. These problems are solved by the congestion-aware routing protocols in certain degree. These protocols which are adaptive to congestion status of mobile ad-hoc network can greatly improve the network performance. In this paper, we present the survey of congestion adaptive routing protocols for mobile ad-hoc network. Finally, the future direction of congestion-aware routing protocols is described.

Keywords: Ad hoc networks, congestion aware routing, Congestion metric, congestion adaptability

1.INTRODUCTION

Reducing packet loss in MANETs typically involves congestion control running on top of a mobility and failure adaptive routing protocol at the network layer. In the current designs, routing is not congestion-adaptive. Routing may let a congestion happen, which is detected by congestion control, but, to deal with this fact, it may be too late (i.e., long delay and many packets already lost) or require significant overhead if a new route is needed. This problem becomes more visible especially in large-scale transmission of high traffic such as multimedia data, where congestion is more probable and the negative impact of packet loss on the service quality is more of significance. We argue that routing should be aware of and adaptive to congestion and therefore propose a unicast routing protocol which tries to minimize congestion in the first place and adapts to it should it occur during the network lifetime.

1.1Cluster-Based Routing Protocol (CRP)

Cluster-Based routing protocol (CRP) was proposed for wireless mesh network. The authors devise alternative strategies for routing against broadcast techniques used in the previous route request to entire nodes in the network. They gave some extra power and responsibility to mesh portalpoint (MPP) and cluster head of each group. The network partitioned into the clusters help reduce the initial broadcast to all nodes. As each cluster has one cluster head that have all information of its neighbor and so path request only multicast to different cluster heads only. The scheme distributes the whole mesh network into groups of clusters. Mesh point portal (MPP) assigned one node as a cluster head (CH) of each cluster group and stored the cluster head information in its own table such as CH id, CH neighborsetc.Each CH has some extra authority compare to others cluster member. Each CH has two tables, the first table stores the information of neighborsCHs while second table stores the information about cluster group member which is assigned by the MPP. Every cluster member stores the information of his CH. When a normal cluster member wants to communicate with any destination node, its ends path request (PREQ) message to his CH, while the CH check its own group member list. If the destination exists in the same group, it sends path reply with path information quickly and source node starts transmission according to that path. If destination node belongs to other cluster, CH sends PREQ message to mesh portal and the mesh portal multicast PREQ message to all CHs. The scheme uses MPP multicast during path discovery for only once while unicast is used in all remaining transmission messaging. Hence it reduces power consumption and improves the network performance. Mesh portal and cluster head periodically updates own table that helps to detect any change. Despite the simplicity and effectiveness, there is no measure to control congestion either adaptively or dynamically.

1.2 CRP is on-demand and consists of the following components

When no. of packets coming to the node exceeds its carrying capacity, node becomes congested and its starts losing packets. Various metrics are used for node to monitor congestion status. Main parameters are percentage of all packets discarded for lack of buffer space, the average queue length, the no. of the packets timed out and retransmitted, average packet delay. In all these parameters, rising number indicates growing congestion.

2. Primary Route Discovery

Sender discovers the route to the receiver by broadcasting the REQ packet toward receiver. The receiver responds REQ by sending the REP packet on same path that the REQ previously followed. This is called primary route and nodes on this are called primary nodes. To reduce traffic due to the primary route discovery and better deal with Congestion in the network, 2 strategies are adopted 1) REQ is dropped if arriving at a node which is having congestion status as "red" 2) REQ is dropped I arriving at node already having a route to destination.

3. Bypass Discovery

A node periodically broadcasts to neighbors a UDT (update) packet. This packet contains this node's congestion status and a set of tuples fdestination R, next green node G, distance to green node mg, each for a destination R that the node has a route to. The purpose is that when a node N receives a UDT packet from its next primary node Nnext regarding destination R, N will be aware of the congestion status of Nnext and learn that the next green node is G which is m hops away on the primary route. If Nnext is yellow or red, a congestion is likely ahead if data packets continue to be forwarded on link N ! Nnext. Since CRP tries to avoid congestion from occurring in the first place, N starts to discover a bypass route toward node G - the next green node of N known from the UDT packet. This bypass search is similar to primary route search, except that: (1) the bypass request packet's TTL is set to 2 £ m, and (2) the bypass request is dropped if arriving at a node (neither N nor G) already present on the primary route. Thus, it is not costly to find a bypass and the bypass is disjoint with the primary route, except that they join at the end nodes N and G. It is possible that no bypass is found due to the way the bypass request approaches G. In which case, we continue using the primary route. However, [1] finds that the chance for a "short-cut" to exist from a node to another on a route is significant.

3.Traffic Splitting and Congestion Adaptability

Now that the bypass at a node has been found, data packets coming to this node are not necessarily spread over the bypass and the primary link. Indeed, as long as the next primary node is not red, no packet is forwarded on the bypass. This is because the primary route is still far from congested and we do not want to impose any unnecessary burden on the bypass nodes. We find bypass proactively as we can use it immediately if the next primary node becomes red (indicating severe congestion).

4. Multi-path Minimization

To keep the protocol overhead small, CRP tries to minimize the use of multiple paths. If prTab[N;R]: (e.g., within a pre-defined threshold), this means the next primary node is far from congested or the bypass route is very congested. In this case, N removes the bypass. If prTab[N;R]:prob approaches zero, this means that the next primary node is very congested. In this case, the primary link is disconnected and the bypass becomes primary. In either case, all the bypass nodes are informed of the decision and their routing tables are modified accordingly. To further reduce the use of multi-pathing and keep the protocol simple, CRP does not allow a node to use more than one bypass. Therefore, the bypass route discovery is only initiated by a node if no bypass currently exists at this node. The protocol overhead for using bypass is also reduced because of short bypass lengths. A bypass connects to the first Non-congested node after the congestion spot, which should be just a few hops downstream.

5. Failure Recovery

CRP is able to quickly resume connectivity after a link breakage by using bypass routes currently available. There are 3 min cases of failure Primary link failure when one of link on primary route fails, the initial node sends a DISC packet towards sender along route. This DISC goes on recording nodes and it stops at node having bypass. This node if finds that its bypass Destination is there in DISC, that bypass is not used and DISC is forwarded upstream towards sender till it finds a node with bypass and not having failed node as its destination. If both these cases are not there DISC is sent to the sender and it will find new primary route.

6. Bypass link or node fails

In this case bypass node which finds this failure sends a BPS_DISC packet through bypass route to primary node and that bypass is removed. Primary node fails If node on the primary route fails, its previous node sends DISC packet along primary route. If the bypass node detects some failure, it will also send BPS_DISC packet along bypass until reaching a primary node. When primary node received both these packet, it removes bypass and DISC packet is forwarded along primary route. Then this is handled same as first case. If BPS_DISC packet doesn't arrive at the primary node on time that bypass is used as primary route. But, if it comes late, it is ignored. But, route remains broken but it will recover soon because another DISC packet will be sent back.

7. PERFORMANCE STUDY

We implemented CRP using the Network Simulator Ns-2 version 2.27 [10] with the CMU Monarch wireless extensions. We compared CRP to DSR and AODV, two of the most popular MANET routing protocols.

8. Conclusion and Future Work

In this paper, we tried to expose the strong and weak points of some of these existing cluster based solutions for routing and congestion control in wireless mesh networks. Though the lists are not exhaustive, but we are tactical in the discourse approach to some of these fundamental algorithms for clustering. We conclude that many of these clustered solutions are found wanting in solving congestions problems in WMNs without modifications to their original forms. Some are in an attempt to improve routing techniques, imposed more overheads and introduce more packets to the network which results in nodes bottlenecks and network congestions. CRP is unique in its adaptability to congestion. Although our preliminary evaluation study has shown the promising performance of CRP, our future work will expand this study to experience with different network scenarios. We will also focus on optimization techniques for CRP and how different congestion predication and control mechanisms cooperate with it to better reduce congestion in MANETs.

References

[1] Akyildiz I.F and Wang X.: Wireless Mesh Networks, Advance Texts in Communications and Networking. John Wiley & Sons Ltd. Chichester, West Sussex, England, 2009.

[2] Baker D. &Ephremides A.:"The architectural organization of a mobile radio net-work via a distributed algorithm". Communications, IEEE Transactions on [legacy, pre -1988] 29(11), 1694– 1701, 1988.

[3] Basagni, S.: "Distributed Clustering Algorithm for Ad Hoc Networks," In Proceeding of International Symposium on Parallel Architectures, Algorithms, and Networks, pp. 310–15, 1999.

[4] Basagni, S.: "Distributed and Mobility-Adaptive Clustering forMultimedia Support in Multi-hop Wireless Networks", in Proceedingsof Vehicular Technology Conference, Vol. 2, pp. 889-893, 1999.

[5] Basagni, S., I. Chlamtac, & A. Farago:"A generalized clustering algorithm for peer-to-peer networks". In Workshop on Algorithmic Aspects of Communication, 1997.

[6] Basu P., Khan N. & Little T.: "A mobility based metric for clustering in mobile ad hoc networks". icdcsw, 0413, 2001.

[7] Chan, H. &Perrig A.: "Ace: An emergent algorithm for highly uniform cluster formation". In Proceedings of the First European Workshop on Sensor Networks (EWSN, pp.154–171, 2004.

[8] Chatterjee M., Das S. K. and Turgut D.:"WCA: AWeighted Clustering Algorithm for Mobile Ad Hoc Networks".Cluster Computing 5 (2), Kluwer Academic Publishers. pp 193–204, 2002.

[9] Chen W.,Hou, J. and Sha L.: "Dynamic clustering for acoustic target tracking in wireless sensor networks," In 11th IEEE International Conference on Network Protocols, 2004.

[10] Chen X., Jones H.M. and Jayalath A.D.S.: "Congestion-Aware Routing Protocol for Mobile Ad Hoc Networks", IEEE, 2007.

[11] Cheng H.O, Zhuang W and Saleh A.: "Joint QoS-aware Node Clustering and Tax-based Subcarrier Allocation for Wireless Mesh Networks". In the IEEE "GLOBECOM" 2008 proceedings, IEEE Communications Society 2008

[12] Chinara, S. & S. Rath:"A Survey on One-Hop Clustering Algorithms in Mobile Ad Hoc Networks". Journal of Network and Systems Management 17(1), 183–207, 2009.

[13] Durresi A., Paruchuri V., and Leonard Barolli L.: "Adaptive Clustering Protocol for Wireless Networks". In the Proceeding of 24th IEEE International Conference on Advanced Information Networking and Applications, pp 105-111, 2010.