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Analytical evaluation of AODV by applying adaptive hello messaging scheme for neighbor discovery under group mobility in wireless ad-hoc network

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Abstract

Mobile ad hoc networks (MANETs) are self-organizing networks and dynamic nature. Due to dynamic nature of wireless network, high mobility of nodes in mobile ad hoc networks, there exist frequent link breakages which lead to frequent path failures and neighbor discoveries. Various approaches proposed for neighbor discoveries widely-used scheme Periodic Hello messaging to obtain local link connectivity information. In Hello messaging schemes hidden energy consumption is high, a novel approach presented to reduce that hidden energy consumption is an adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages. Used and modify the traditional routing protocol AODV to AODV-AH for evaluate the performance of novel scheme. Node coordination affect on performance ad-hoc network that evaluated under group mobility models. In the novel scheme, the AODV-AH performance not evaluated under the any group mobility model. Here in paper evaluate the performance of AODV-AH under the group mobility model with modified simulation environments in ns-2 that until not done as per analytical investigation. An adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages that strongly directed to that the energy consumption of network also reduce in group mobility low and high mobility environment.

Keywords: MANET, AODV, Hello packet, Group mobility

1. Introduction

Nodes can change position quite frequently, which means that need a routing protocol that quickly adapts to topology changes. The node in an ad-hoc network can consist of laptops and personal digital assistants and are often very limited in resources such as CPU capacity, storage capacity, battery power and bandwidth, so the routing protocol should try to minimize control traffic, such as periodic update messages. In MANETs, any node in a route can move away or be turned off, which negatively affects route maintenance and throughput may cause delays in data dissemination, and so on. Local link connectivity information is extremely important for route establishment and maintenance. Periodic Hello messaging is a widely-used scheme to obtain local link connectivity information. For neighbor discovery, periodically exchanging Hello messages is preferred over link layer feedback because the former does not restrict usage and implementation to a specific link layer technology such as ACK packets. In Hello messaging approach because the unnecessary Hello messaging can drain batteries while mobile devices are not in use. The reactive Hello protocol enables Hello messaging only when it is demanded using a Hello request-reply mechanism, but increases delay due to additional packet exchange before communication. The event-based Hello protocol enables only active nodes (i.e., those either sending or receiving data packets) to broadcast Hello packets based on a threshold called an activity timer. However, a threshold that is set too high rarely reduces the Hello messaging overhead, whereas a low threshold results in local connectivity information loss. Thus, there is an

outstanding need to effectively suppress unnecessary Hello messaging while minimizing the risk of losing local connectivity information [2]. An adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages [2]. This framework reduces battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detestability of a broken link, which decreases network overhead and hidden energy consumption. There are other may work also presented by research to reduce the energy consumption and routing overhead, with the same issue for energy consummation reduction proposed the Unilateral Wakeup for Mobile Ad Hoc Networks with Group Mobility in [3]. A new wakeup scheme, named Unilateral- (Uni-) scheme, for MANETs that allows nodes with slower moving speed to sleep more without losing the network connectivity. The Uni-scheme supports both the entity mobility and group mobility of nodes, thus has broad applicability. In review found that mobility patterns have been used to derive traffic and mobility prediction models in the study of various problems in any network systems, such as handoff, location management, paging, registration, calling time, traffic load, routing overhead, energy consumption and other performance evaluations. In network system, mobility models are mainly focused on individual movements since communications are point to point rather than among groups; in ad hoc networks, communications are often among teams which tend to coordinate their movements. For example ordinary nodes (soldiers walking on a battlefield) usually move way slower than the fastest one (soldiers carried by an armored vehicle), this motivate to evaluate routing protocol under group mobility. In this paper, focused on an adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages by which the power consumption metric improve the performance, this frame work not evaluated on group mobility environment. In ns-2 with different group mobility model this paper evaluate the performance of [2], as stated in [2] power consumption metric improve the performance by suppressing unnecessary Hello messages continuing with group mobility environment or not as stated in [3].

2. Background

Nodes can change position quite frequently, which means that need a routing protocol that quickly adapts to topology changes. To be effective, the routing protocols have to Keep the routing table up-to-date and reasonably small, choose the best route for given destination and Converge within an exchange of a small amount of messages. In [1], primary focused much on to variable number of node and constant pause time that very less evaluated. Used random way point mobility model; routing protocol AODV, DSDV and DSR; Cbr traffic, constant pause time 0 and varying speed 2-40 m/s. performance metrics evaluate here are End-to end delay throughput, Average end-to end delay, Packet delivery faction ratio, Routing packet overhead, Normalized routing load, Packet loss ratio. The unnecessary Hello messaging can drain batteries while mobile devices are not in use. The reactive Hello protocol enables Hello messaging only when it is demanded using a Hello request-reply mechanism, but increases delay due to additional packet exchange before communication. The event-based Hello protocol enables only active nodes (i.e., those either sending or receiving data packets) to broadcast Hello packets based on a threshold called an activity timer. However, a threshold that is set too high rarely reduces the Hello messaging overhead, whereas a low threshold results in local connectivity information loss. Thus, there is an outstanding need to effectively suppress unnecessary Hello messaging while minimizing the risk of losing local connectivity information [2]. In review of [3] found, asynchronous wakeup schemes to the Mobile Ad Hoc Networks is nodes with lower mobility to sleep more in reaction to the less-changing link states, in practice this is prohibited due to an unwanted tradeoff between the energy saving and in-time link discovery. All nodes in a network must stay awake frequently based on their highest possible moving speed in order to avoid network partition. In proposed work the Uni-scheme to address some practical limitations of existing AQPS Protocols, some of them the power saving advantage given by an AQPS protocol comes at the price of delay. This includes the neighbor discovery delay, i.e., the time required for a station to discover its new neighbor, and data buffering delay, i.e., the duration between a packet arrival (on a sending station) and its start of DCF.

To addres the review problem a new wakeup scheme, named Unilateral- (Uni-) scheme proposed in [3], for MANETs that allows nodes with slower moving speed to sleep more without losing the network connectivity. The Uni-scheme supports both the entity mobility and group mobility of nodes, thus has broad applicability.

3. Previous work done

In [2], much of the initial proposed work was based on using random waypoint as the underlying mobility model and Constant Bit Rate (CBR) traffic consisting of randomly chosen source-destination pairs as the traffic pattern with traditional routing protocols like DSR, DSDV, and AODV. Mainly evaluate the following metrics: packet delivery ratio, end to end delay and routing overhead found that on-demand protocols such as DSR and AODV performed better than table driven ones such as DSDV at high mobility rates, while DSDV performed quite well at low mobility rate. DSR outperforms AODV in less demanding situations, while AODV outperforms DSR at heavy traffic load and high mobility. However, the routing overhead of DSR was found to be lesser than that of AODV. Random waypoint is too simple and general model, recent research has started focusing on alternative mobility models and protocol independent metrics to characterize them. Some conducted a scenario based performance analysis of the MANET protocols. In [2], used only traditional routing protocol for performance evaluation and not declare clear winner of the compressions. In such traditional Hello messaging schemes no start/end condition proposed. This can cause unnecessary bandwidth usage and hidden energy consumption if an on-demand MANET routing protocol (e.g., Ad hoc On-Demand Distance Vector (AODV), or Dynamic MANET On-demand (DYMO) used, where a new path is discovered through Route Request (RREQ) and Route Response (RREP) packet exchanges. Two approaches for suppressing Hello messages when they are not required proposed an on-demand mechanism (reactive Hello protocol), and a monitoring activity mechanism (event-based Hello protocol). An adaptive Hello interval scheme in [2] used to reduce battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detestability of a broken link, which decreases network overhead and hidden energy consumption. In [3] proposed work the Uni-scheme to address some practical limitations of existing AQPS Protocols, some of them the power saving advantage given by an AQPS protocol comes at the price of delay. This includes the neighbor discovery delay, i.e., the time required for a station to discover its new neighbor, and data buffering delay, i.e., the duration between a packet arrival (on a sending station) and its start of DCF. The proposed framework identified several shortcomings of existing quorum schemes if to be applied to the MANETs, and proposed the Uni-scheme. unilateral wakeup is introduced that allows nodes with slower moving speed to save more energy. The Uni-scheme is applicable to MANETs with group mobility. The Uni-scheme is carefully designed such that it is compatible with existing quorum schemes for clustered networks. The Uni-scheme is able to render significant improvement in energy efficiency while guaranteeing the network connectivity.

4. Existing methodology

In [1], Performance Evaluation of Mobility Speed over MANET Routing Protocols, the major challenge of ad ad-hoc network are mobility and link failure that affect the protocol performance that studied here. In [1], primary focused much on to variable number of node and constant pause time that very less evaluated. Used random way point mobility model; routing protocol AODV, DSDV and DSR; Cbr traffic, constant pause time 0 and varying speed 2-40 m/s. performance metrics evaluate here are End-to end delay throughput, Average end-to end delay, Packet delivery faction ratio, Routing packet overhead, Normalized routing load, Packet loss ratio. The unnecessary Hello messaging can drain batteries while mobile devices are not in use. The reactive Hello protocol enables Hello messaging only when it is demanded using a Hello request-reply mechanism, but increases delay due to additional packet exchange before communication. The event-based Hello protocol enables only active nodes (i.e., those either sending or receiving data packets) to broadcast Hello packets based on a threshold called an activity timer. However, a threshold that is set too high rarely reduces the Hello messaging overhead, whereas a low threshold results in local

connectivity information loss. Thus, there is an outstanding need to effectively suppress unnecessary Hello messaging while minimizing the risk of losing local connectivity information [2]. In review of [3] found, asynchronous wakeup schemes to the Mobile Ad Hoc Networks is nodes with lower mobility to sleep more in reaction to the less-changing link states, in practice this is prohibited due to an unwanted tradeoff between the energy saving and in-time link discovery. All nodes in a network must stay awake frequently based on their highest possible moving speed in order to avoid network partition. In proposed work the Uni-scheme to address some practical limitations of existing AQPS Protocols, some of them the power saving advantage given by an AQPS protocol comes at the price of delay. This includes the neighbor discovery delay, i.e., the time required for a station to discover its new neighbor, and data buffering delay, i.e., the duration between a packet arrival (on a sending station) and its start of DCF. To addres the review problem a new wakeup scheme, named Unilateral- (Uni-) scheme proposed in [3], for MANETs that allows nodes with slower moving speed to sleep more without losing the network connectivity. The Uni-scheme supports both the entity mobility and group mobility of nodes, thus has broad applicability.

5. Analysis and Discussion

The major challenges of ad ad-hoc network are mobility and link failure that affect the protocol performance that studied here. In [1], primary focused much on to variable number of node and constant pause time that very less evaluated. Used random way point mobility model; routing protocol AODV, DSDV and DSR; Cbr traffic, constant pause time 0 and varying speed 2-40 m/s. performance metrics evaluate here are End-to end delay throughput, Average end-to end delay, Packet delivery faction ratio, Routing packet overhead, Normalized routing load, Packet loss ratio. Neighbor discovery become vast issue of research due to ad ad-hoc network challenges are mobility and link failure, so that research introduce different approaches of neighbor discovery as stated above in [2]. Periodic Hello messaging is a widely-used scheme to obtain local link connectivity information. Energy consumption and network overhead increased in Hello messaging approach because the unnecessary Hello messaging can drain batteries while mobile devices are not in use. The reactive Hello protocol enables Hello messaging only when it is demanded using a Hello request-reply mechanism, but increases delay due to additional packet exchange before communication. The event-based Hello protocol enables only active nodes (i.e., those either sending or receiving data packets) to broadcast Hello packets based on a threshold called an activity timer. However, a threshold that is set too high rarely reduces the Hello messaging overhead, whereas a low threshold results in local connectivity information loss. Thus, there is an outstanding need to effectively suppress unnecessary Hello messaging while minimizing the risk of losing local connectivity information [2]. An adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages [2]. This framework reduces battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detestability of a broken link, which decreases network overhead and hidden energy consumption. The proposed scheme in [2] does not reduce the detestability of a broken link; that is, only unnecessary Hello packets are suppressed. Scope to extend the work of [2] is improving the neighbor discovery and enhances the performance of the Hello messaging scheme for energy saving and reducing the overhead. The framework in [2] modified AODV and DYMO with the proposed scheme, which called AODV with adaptive Hello (AODV-AH) and DYMO with adaptive Hello (DYMO-AH) respectively. Evaluate performance of modified routing protocol in [2] with simulation parameters were constant pause time 0 i.e. high mobility environment with node speed 5-30 m/s but only one simple mobility model used random way point mobility model and varying number of node also less. Various simulation parameters including node density, number of flows, mobility speed, and PFD. Reduces the number of unnecessary Hello packets, energy is saved due to less transmission and less receptions. Investigated the throughput of ftp over tcp and pareto flows and energy consumption when the number of flows varies. No throughput drop is observed, which shows that the proposed scheme does not reduce the detestability of a broken link; that is, only unnecessary Hello packets are

suppressed. The event interval of a node, the Hello interval can be enlarged without reduced detestability of a broken link, which decreases network overhead and hidden energy consumption. In review of [3] found, to reduce the energy consumption in high dynamic and group mobility environments studied the asynchronous wakeup schemes; nodes with lower mobility to sleep more in reaction to the less-changing link states, in practice this is prohibited due to an unwanted tradeoff between the energy saving and in-time link discovery. All nodes in a network must stay awake frequently based on their highest possible moving speed in order to avoid network partition. In proposed work [3] the uni-scheme to address some practical limitations of existing AQPS Protocols, some of them the power saving advantage given by an AQPS protocol comes at the price of delay. This includes the neighbor discovery delay, i.e., the time required for a station to discover its new neighbor, and data buffering delay, i.e., the duration between a packet arrival (on a sending station) and its start of DCF. The proposed framework in [3] identified several shortcomings of existing quorum schemes if to be applied to the MANETs, and proposed the Uni-scheme. The concept of unilateral wakeup is introduced that allows nodes with slower moving speed to save more energy. The Uni-scheme is applicable to MANETs with group mobility. The Uni-scheme allows nodes in a moving group to pick cycle lengths based on the relative speed in the group (which is usually slow) rather than the relative speed between groups.

6. Proposed Methodology

Hello messaging schemes focus on figuring out dynamic network. Discovered live neighbor with energy saving scheme, which requires all network nodes to continuously exchange Hello messages or beacons while they are awake. In such traditional Hello messaging schemes no start/end condition. This can cause unnecessary bandwidth usage and hidden energy consumption. To resolve this issue a novel approach proposed in [2] is an adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages. After analyzed proposed work found that, the framework reduces battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detestability of a broken link, which decreases network overhead and hidden energy consumption. Proposed work were modified the AODV and DYMO with the Hello messages scheme, which called AODV with adaptive Hello (AODV-AH) and DYMO with adaptive Hello (DYMO-AH) respectively. Evaluate performance of modified routing protocol in [2] with simulation parameters were constant pause time 0 i.e. high mobility environment with node speed 5-30 m/s but only one simple mobility model used random way point mobility model and varying number of node also less. As discussed about group mobility in previous section, coordination of node movement effect the performance on the network, it is primarily motivate to evaluate the performance of an adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages [2] in group mobility environment stated in [3].

Modified simulation parameters are as follows:

- Used AODV routing protocol to modified in AODV-AH
- Any group mobility model (RPGM: Reference Point Group Mobility Model, RWG: Random Waypoint Group Mobility Model, RDG: Random Direction Group Mobility Model , MHG: Manhattan Group Mobility Model, SQG: Sequential Group Mobility Model and others)
- Constant pause time: 0
- Node speed : 1 - 40 m/s
- Varying number of node: 50 / 100
- 20 sources sending packets to 20 receivers at constant bit rate ranging from 2 to 8 Kbps [3] / increase.
- Each node has half-duplex wireless channel of rate 2- 11 Mbps and transmission range 100 m.
- Nodes are divided evenly into 5 or more groups.
- In each group, the reference points of nodes are randomly distributed within 50 m around the center.

7. Possible outcome and result

Performance result and conclusion in [2] strongly directed that, framework in [2] also maintain consistency in reduction of energy consummation performance metric under the group mobility models. Proposed work affect following performance metric:

- Hidden energy consumption reduces.
- Routing overhead reduces.
- Packet delivery ratio
- Hello packet over head
- Throughput

8. Conclusion

The link failure and mobility is major challenges for ad-hoc network. Due to that difficult to the neighbor discovery, packet transmission, link failure and power consumption like problem occurred. The different mobility models are used to evaluate the effect of mobility and link failure. Analyzed impact of different mobility model on traditional routing protocol with constantan pause time and varying number of node; under the group mobility coordination of node affect the performance on ad-hoc network. Energy constrain is most important factor of wireless network, so that various approaches used to reduce the consumption of power in wireless networks. A novel approach analyzed here in [2] on basis of neighbors discovery by hello messaging scheme by reducing unnecessary hello message packet reduce the hidden energy consumption. Modify the AODV protocol into AODV-AH. As per motivation this paper evaluating the performance of AODV-AH in group mobility and also use the simulation environment stated in [3] that not done earlier. The suppressing unnecessary Hello messages in environment of group mobility strongly directed that enhance the power consumption metric here also.

9. Applications

Utilized in on-demand routing protocol for energy saving and overhead reduces.

10. Future Scope

Improve the technique of neighbor discovery and enhance the performance of the Hello messaging scheme for energy saving percentage. The approach proposed in [2] used on the beacon base neighbor discovery algorithms to enhance the performance of routing protocol. In future, innovating new approaches to enhance different performance metrics of suppressing unnecessary Hello messages scheme over different routing protocol; under simple and group mobility model with high dynamic network environment.

11. References

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