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Research Article

Multipath Routing Mechanisms for MANET: A Review

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Abstract

In MANETs, mobile wireless nodes connect to one other and exchange data without depending on a fixed base station or wired network backbone. When it comes to MANET nodes, they tend to be restricted in their availability of power, compute, and memory, as well as their mobility. It is possible that the cellular cell nodes may join the network dynamically and leave the network as well. Wireless network nodes typically need several hops to exchange information with other network nodes owing to the poor contact rate. Routing is, thus, essential in the design of a MANET. In this article, we specifically examine multipath routing in MANETs. By using multipath routing, it is possible to have several routes between a single source node and a single destination.
Keywords: MANET, Intermediate Node, Route Discovery, Dynamic Source Route, RREQs

1 Introduction

In the case of an ad hoc network, such as a MANET, the mobile nodes have access to each other through short-range wireless links, but they don't connect to a permanent infrastructure like a cellular tower or a traditional LAN. MANETs have many potential implementations in a number of different environments. When military combat signalers have to be transferred to lightweight sensors that are dropped and distributed on the ground, pollutants in high altitudes have to be found. It is not only simple scenarios such as hotels, airports, or stadiums that utilize MANETs, but more complicated events, such as highway vehicles forming an ad hoc vehicle traffic management network. When it comes to MANET nodes, they tend to be restricted in their availability of power, compute, and memory, as well as their mobility. Such networks may support portable wireless nodes that enter and exit the network dynamically. Nodes use a network of network nodes to relay information to other nodes on the network. Each node must travel a number of hops to establish a connection with every other node on the network. Routing is, thus, essential in the design of a MANET. For conventional wired networks, routing methods use either distance vector or connection state algorithms. The methods used by both routers allow each of them to broadcast periodic routing announcements.A distance vector network will have each router transmitting its estimation of the distance to all of its neighbors, which are the next nearest routers, to all the routers it borders. The neighboring routers, which are the next closest routers, then make the final calculation to determine the shortest path to each node. Link-state routing works by each router telling its surrounding nodes of the state of each of its links; the neighboring nodes then use

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this information to build a shortest path to each destination based on the whole topology of the network. The efficacy of these routing algorithms is highly dependent on the number of complicated changes that occur in an ad hoc network. Most routers do not make changes on conventional networks, save on very rare occasions when they leave or enter the network. Even in a mobile node scenario, when network topology has to change, re-computing conventional routes will not be possible. This is because overall convergence to stable routes is more difficult in the presence of a significant degree of mobility.

Mobility must be accounted for in MANET routing because essential characteristics, such as node mobility, are also important. In this article, we specifically examine multipath routing in MANETs. Routing that supports multipath has the ability to make numerous routes from a single source to a single destination node. The most basic rule in this context is that multipath routing is often a good idea for increasing data transmission efficiency. Common routing protocols are used especially to find a single route between a source and a destination node in ad hoc wireless networks, such as AODV and DSR. Multiple routes between the destination node and the source node are installed in multipath routing. These various routes may be used to connect nodes in an ad hoc network. The following features may be applied to several paths: load balancing, fault tolerance, and greater aggregate bandwidth. Load balancing may be accomplished by spreading the traffic out over many different roadways. Bottlenecks would be eliminated and congestion eased by this. A fault tolerance perspective sees multipath routing having route continuity. A wireless network has a shorter range, therefore your signal will be weaker. Routing via a single route can't offer you with a link with enough capacity. The program's bandwidth requirements will be met if various routes are utilized to transport data while concurrently satisfying the program's requirements. The higher your throughput, the lower your end-to-end latency. While it may be easier to utilize many routes in ad hoc networks to achieve more bandwidth, security concerns complicate the usage of various routes in ad hoc networks. Radio interference is a significant problem since network nodes communicate via the wireless network. Interference may reduce the effectiveness of node broadcasts as well as path transmissions on the same node.

Multipath routing is used in MANETs, which allows several programs to be delivered. Here we offer multipath routing methods that aid in fault tolerance, resource conservation, latency reduction, and bandwidth availability. When using DSR and AODV, DSR is more flexible due to its ability to deal with multipath traffic when combined with single path routing. With DSR, as long as a route cache is maintained, there is no need to keep forwarding tables as in AODV. The need to specify the whole route in the packet header, as with DSR, takes up additional cost when forwarding data packets. From the specifications of the parent protocols, these benefits and disadvantages are derived by the multipath additions to DSR and AODV. To reiterate, SMR offers the main advantage, and any multipath addition to DSR is multifunctional. In both AODV and DSR, intermediate nodes may use RREQs to refer to destinations, which may lead to shorter route exploration times. SMR and AODVM do not allow intermediate nodes to react to route discoveries in order to prevent a single destination from taking several discontinuous pathways. The main advantage of AOMDV is that it enables discontinuous routes to be handled by the intermediate nodes, while simultaneously giving intermediate nodes the power to choose their route preferences. At all intermediate nodes, the three multipath protocols do not reject any duplicate RREQs. It motivates us to search for other possibilities. Path exploration happens to have additional overhead messages as a result of increased runoff. RREQs inside the multipath protocols also cause the destination to respond, which means there is extra overhead. In SMR and AOMDV, however, the destination only responds to the RREQs that fall inside the subset of requests in the request-response exchange. With multipath routing systems, complexity and overhead are the primary constraints. In multipath extensions to AODV, having several paths to a target leads in larger routing tables at intermediate nodes. As described in the next section, multipath routing requires that you take into consideration the method by which packets are allocated to various paths. Reordering of packets is a possibility if multipaths are used for routing. Since just one route is utilized, the distribution of traffic is not an issue for unipath routing.

2.Literature survey

Noor Mast, Muhammad Altaf Khan, M. Irfan Uddin, Syed Atif Ali Shah, Atif Khan, Mahmoud Ahmad Al-Khasawneh, and Marwan[1] Mahmoud presented a routing protocol named CCBRR (Channel Contention Based Routing). CCBR is hoping to discover a less controversial route between the endpoints in order to enhance the packet distribution ratio and reduce packet delay and normalized routing overhead. The channel congestion ranking at each intermediary node is calculated on the basis of the data packets that are active. A surge in channel congestion at the intermediate node will notify the source node. And the source node searches for a less-bogged-down route to the rest of the network. Hyukjoon Lee, Donghoon Jeon, [2] presented a novel multi-path routing system for MANETs that emphasizes biological attractor selection, making the network more stable and able to adapt to changing conditions. Based on the results of the simulation, there is a significant amount of change in terms of packet propagation ratio, QoS transmission ratio, and overall throughput. A new protocol that reduces energy, conserves network life, reduces overhead routing, and boosts network performance is called for, which is known as Energy Reduction Multipath Routing Protocol for MANET using Recoil Technique (AOMDV-ER). Dr. Sahu, and Dr. Chaudhari .S[3] In order to reduce network packet losses, we use the prediction-based connection lifespan for each node. This protocol has three distinct sections: a joint path-discovery and residual energy and distance method that may be used to analyze several paths and explore each of them while excluding all data latency reduction transfers, slow traffic, overhead routing, end-to-end pauses, and network lifespan increases (SRMP). Despite the fact that the new algorithms may be more accurate, the AOMDV-ER algorithm works better. A scalable multi-path routing system designed to provide load balancing while preventing MANET congestion is proposed by Soundararajan and Bhuvaneswaran, [4]. To minimize the chance of any path of the multipeak line on the main line failing, several fail-safe paths are calculated for each intermediate node and all these pathways reach the ultimate goal. Use of several fail-safe pathways results in nodes with lower loads, allowing for greater battery capacity and residual electricity. As a route's cumulative traffic load increases beyond a certain level, it divides traffic among several paths to reduce strain on a crowded connection. Ali, M., Stewart, B. G., Shahrabi, A., and Vallavaraj, A. [5] provide a fuzzy logic-based method to improve MANET congestion and latency by providing for delay, load, and energy-conscious routing. Traffic delivery from a mobile node is evaluated based on fuzzy rules specified in the proposed method using forwarding delay, average load, useable bandwidth, and remaining battery energy as inputs. In order to minimize the load at a crowded node, traffic is distributed across multiple fail-safe pathways. Sungwook Kim [6]developed a contemporary multipath routing system via the use of a virtual annealing technique. Suggested metaheuristic solutions will acquire increased and reciprocal benefits in an aggressive, complicated real-world network scenario. Using the proposed method, the answer to the issue of simultaneously ad hoc cell network routing becomes easier to find. A novel cross-layer method to MANET routing, suggested by Mahadev A. Gawas, Lucy J. Gudino, and K. R. Anupama[7], is termed congestion-adaptive and delay-sensitive multi-rate (CADM) routing protocol. The CADM protocol uses the networking and the MAC layers together with the physical layer to create a link across layers. CADM looks at data throughput, network congestion, and MAC delay to help make MANETs function better. For faster networks that can handle higher latency requirements, various node-disjoint routes are supported, and based on the anticipated delay in multirate MANETs, optimal data rates are established between the connections to generate a flow. The proposed CADM protocol selects the least crowded nodes for the route, and when congestion arises, the protocol has the ability to respond quickly and effectively. Low Overhead Localized Flooding (LOLF), an important extension of overhead reduction routing, is promoted by SumetPrabhavat, Worrawat Narongkhachavana, Thananop Thongthavorn, and Chanakan Phankaew[8] This work assists in the monitoring of routing packets in the path research and route maintenance operations, although there is only a little increase in the complexity of packet administration. The results of our extensive simulation tests indicate that implementing our suggested solution would decrease overall routing overhead, energy consumption, and end-to-end delay, all while maintaining the packet distribution ratio. A. H. Mohsin, Bakar, and A Zainal[9] are described as contributing authors. In order to best use the available network resources and identify high-quality connections, two protocols are suggested. the Signal Amplitude and Congestion Prevention Protocol (SSCA). An optimal and flexible HGR protocol limits the search region to just promising search pathways during route discovery by making use of geographical location information. Meanwhile, the SSCA method is used by adaptive SSCA to improve SSCA compatibility and detection of SSCA node accuracy, while also limiting packet decline. Dynamic congestion routing (DCDR) detection and control, in ad hoc networks, is described by T. Senthilkumaran and V. Sankaranarayanan, [10]who recommend a technique that estimates node-level average queue duration based on the time at which the node has a complete view of the data. In order to detect the current congestion level, a node detects the average queue duration of all of its connected neighbors and then notifies them about the status. The neighbors realize that alternative path is necessary, so they deviate from the one that would lead to emissions. To alleviate the complex congestion prediction process that aids congestion control, in ad hoc networks, this sophisticated congestion control method allows for efficient interaction inside the MANET.

3 .The problems associated with multipath routing

Diverse criteria like resilience, mobility, node density, and energy consumption are all possible with no one routing solution. It is difficult to determine the optimum method for ad hoc cell wireless networks to implement multipath routing because of the absence of a general consensus on the subject. Bringing important modifications to an established procedure seems to be important scientific research. There are certain important topics that are poorly dealt with outside of established procedures. When the environment's radio communication characteristics are tough, ad hoc routing methods have difficulty. There may be a number of nodes in a metropolitan region, some of which may be inside and others that may be in tunnels. Other methods will only find one of these extremely serpentine circumstances, or may not detect any of them at all. Up until the newest techniques have come on the scene, security and utility deployments have both proven to be challenging. Although ad hoc wireless systems have less safety requirements than conventional wired networks, safety is just as important. Attacks against wireless networks are becoming more popular due to their common usage. Many ad hoc network protocols aren't much safer than wired ones when a hacked network node is involved. If several routes are built instead of a single route, it is unclear if additional protection issues exist. While the design of the protocols can always guarantee that excellent routes can be created efficiently, even considering malevolent members, it is important to ensure that safe pathways are constantly accessible. Growth in the requirement for ad hoc multipath routing has prompted quick advancement in ad hoc multipath routing technologies. In all likelihood, we'll be able to come to an agreement on design requirements for the protocol in the not-too-distant future. Much more research needs to be done to make sure that mobile ad hoc wireless networks include multipath routing algorithms as an option in the future.

4. Proposed System

It is critical in MANETs for routing to be able to adapt to the intricate web of network topologies. Mobile networks are brought on line when mobile nodes in the environment are identified, tracked, and so on. The mobile network causes a malfunctioning node and radio waves that are very dynamic, so the way is unavailable for extended periods of time. The overhead is considerable, and there is a possibility of extra packet delay. Rather than a single route, which may perhaps lead to inefficient use of resources, using multipath routing means that multiple paths to a destination are present. The significance of successful algorithms varies based on the structure and configuration of the MANETs. Intermediate nodes rely on these routes as a secondary route with source nodes as an alternate route. We suggest a research project that concentrates on finding the multipath that serves to diminish single-path issues, such as delayed arrival in locating pathways, as well as continued failure to find the routes, and possible increased data transmission efficiency degradation.

5.Conclusion

Ad hoc mobile networks have received the attention of many researchers in recent years. There have been many queries as a result of the desire to develop an optimum routing system for an ad hoc network. Redundancy and energy use management are both important in effective routing protocols. Another multipath routing system, Multipath Routing (MANET Multipath Routing), has been proposed to provide consistency, load balancing, and quality of service. This study surveyed the new multipath routing technologies for MANETs. The studied protocols indicated that multipath routing, which accounted for various latency, throughput, efficiency, and lifespan parameters, was a significant enhancement for network performance. However, maximizing all these efficiency factors is a challenge, because each one of them has its own unique procedure. Using a particular implementation and tradeoffs in a multipath routing protocol decision. Energy efficiency, low overall operational cost, longevity, and scalability are just some of the attributes sought for. This study's survey results will provide the necessary information for researchers to focus on, and network designers will discover which protocol to employ, along with figuring out what the protocol's costs and benefits are.

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