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Improving Secure Routing Performance Using Reputation Based on Weighted Hub Selection Model in Manet

Kunal Singh [a], Deepika Chauhan [b]

[a] *Department of Civil Engineering, Riverdale Institute of Technology, Varanasi, India.*
[b] *Department of Civil Engineering, Riverdale Institute of Technology, Varanasi, India.*

Abstract

In today's world, technology is at the heart of communication across all fields. As we move forward, networks are becoming completely mobile, operating without the need for traditional infrastructure, and supporting applications in a flexible, random, and multi-hop setup. This leads to the creation of self-organizing nodes that form a new kind of network (WANET). A specific type of WANET, where nodes are mobile, is referred to as Mobile Ad Hoc Networks (MANETs). These networks have unique characteristics, such as changing topologies, limited bandwidth, and restricted energy resources. Since a MANET operates independently, mobile nodes can be set up on planes, boats, buses, or cars. The reason it is called "ad hoc" is that it is independent of pre-existing infrastructure, such as access points in conventional wireless configurations or routers in wired networks. Rather, every node contributes to routing by forwarding packets to other nodes and choosing which node will send data in real time depending on the state of the network.

Keywords: WANET, MANETs, Routing, Data.

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Introduction

The idea of universal computing showcases a productive and effective approach that highlights the importance of wireless networking and mobile devices. Nowadays, users can access most services electronically and retrieve information anytime, no matter where they are (Anbarasan et al., 2019). This makes wireless communication a rapidly growing innovation. There are two types of wireless networks: infrastructure-based, or established networks, and infrastructure-less, or transitory networks. Switches (routers) and application gateways are components of established networks that are necessary for communication between mobile nodes. The range of a mobile node's location is covered by the link between it and the closest base station. A mobile node connects to another base station that covers the area it has entered when it leaves a base station's coverage area. One excellent illustration of an established network is cellular communication technology (Muneeswari & Manikandan, 2019). Researchers call transient networks "ad hoc networks" from a categorization perspective. The word "ad hoc" suggests that these networks are transient or made for particular purposes. A collection of mobile nodes forms the basis of a self-organizing wireless communication network known as a mobile ad hoc network (MANET). Without a fixed network, like a base station or access point, or human involvement, communication takes place directly between mobile nodes in this configuration (Chintalapalli & Ananthula, 2018). Because MANETs are self-organizing, they can effectively control the entry and exit of nodes from the network while dynamically forming a network of mobile nodes or hosts that can merge or split into separate networks as needed (Singh et al., 2014).

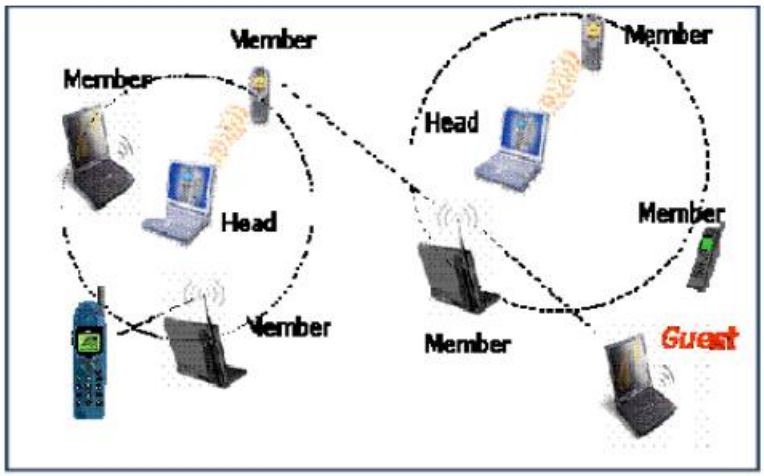

Fig. 1: A Simple MANET Architecture

Self-organizing MANETs prioritize accessibility, dependability, and adaptability (Kumar et al., 2018). Low-power, self-sufficient computing units that are mobile are known as mobile nodes. Due to the mobility of these nodes, the network topology is subject to sudden and unpredictable changes over time. Data packets can be forwarded to other mobile nodes by each mobile node acting as a host and a router. The degree to which the nodes cooperate is a major factor in communication success. In order to successfully communicate, these nodes must constantly find other nodes within their radio range (Hinds et al., 2013).

Background of the Study

A mobile ad hoc network is essentially a collection of more than one node equipped with wireless networking capabilities, all without any central control—think of it as a framework-less mobile network. They communicate directly with devices that are within reach in a decentralized manner (Kurkowski et al., 2005). If a device wants to connect to another that's out of its range, it can rely on nearby devices to relay the connection. In mobile ad hoc networks, all nodes are mobile and can connect in a flexible manner, as illustrated in fig. 1 Since each node has a limited communication range, if one needs to send a packet beyond its reach, it will need assistance from nearby nodes to forward the packets to the intended target. Thus, all nodes in these networks act as relays, participating in route discovery and managing connections to other nodes within the network (Sheikh et al., 2010).

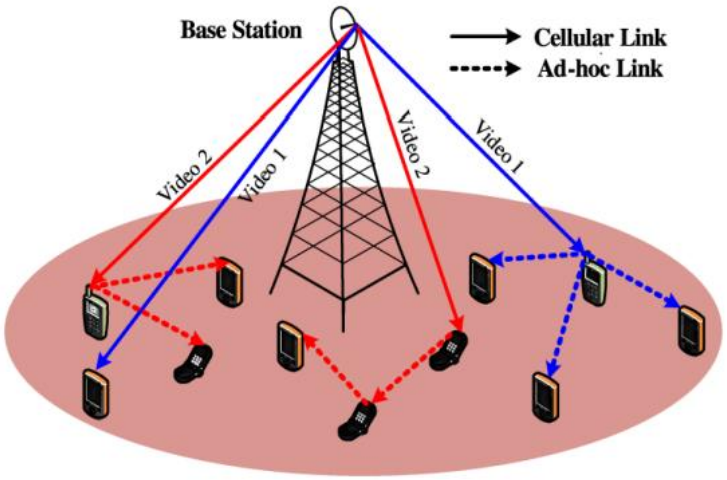

Fig. 2: Ad hoc network connection in radio range

MANETs Characteristics

Here's the text we're looking at: MANETs represent a new standard in systems that allow for free movement without a rigid framework. At their core, an ad hoc system consists of forming a multi-hop network. Here are some key properties of a MANET.

In the comparison of the wired systems

- The wireless network has less safety, quality, limit, productivity and stability as compare to wired network.
- MANET has no organized verification. Circulated nature is adjusted by MANET for the task of host setup, routing and security.
- MANET is independent in nature in which every node is host and router.
- A symmetric domain is made by the nodes of MANET which have comparable component, responsibility and ability.
- Nodes are allowed to include or remove from the network whenever it is needed. There is progressive topology in the MANET.
- MANET having versatile and unconstrained behaviour. So less human interference is required in MANET.

Routing in MANET

In times of crisis and during help activities, Mobile Ad Hoc Networks (MANETs) prove to be incredibly useful. They can be set up quickly whenever needed, even without existing infrastructure. Take a look at Fig. 2, which illustrates a MANET alongside a Wireless Mobile Network. In military operations, gatherings, and classroom meetings, the use of MANETs is equally crucial. In all these scenarios, there's a lot of movement among the nodes, which can complicate transmission. That's why designing an effective routing protocol is essential for successful communication. Fig. 3 shows a MANET scenario focused on routing. We need a routing protocol that not only extends the network's lifespan but also speeds up data transfer among mobile nodes, all while considering the limited energy of those nodes. There are several routing protocols out there that take into account power and delay factors. These protocols are capable of managing a large number of nodes with minimal infrastructure. A key challenge in routing protocols is the constant appearance and disappearance of nodes in various areas. It's crucial to minimize routing message overhead, especially. Another important aspect is keeping the routing table size small, because if the routing protocol's capacity is too large, it can negatively impact the control packets exchanged within the network."

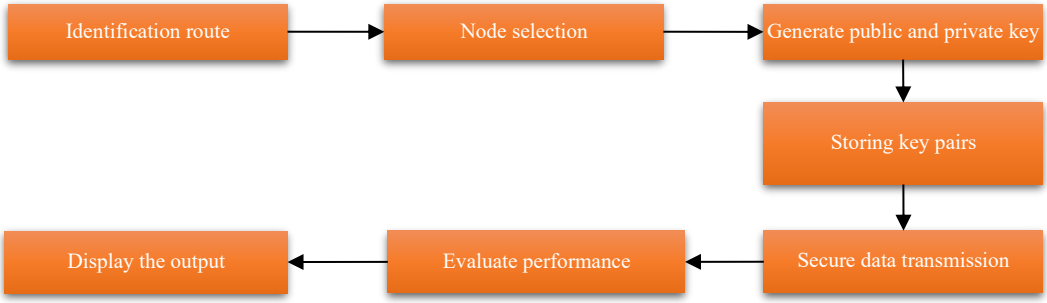

Fig. 3: Secure transmission

Results

With the rise of mobile devices and advancements in wireless communication, ad hoc networks are becoming increasingly important in large-scale operations. These networks can be installed in places with little or no communication infrastructure already in place, or if the present configuration is too expensive or ineffective. Ad hoc networks facilitate seamless device-to-device communication, making it simple to add and remove devices from the network. Mobile Ad Hoc Networks (MANETs) have a wide range of uses, from large mobile systems to smaller, battery-powered stationary networks. In addition to traditional applications transitioning from older infrastructures to ad hoc networks, many new applications are being developed to take advantage of this innovative environment.

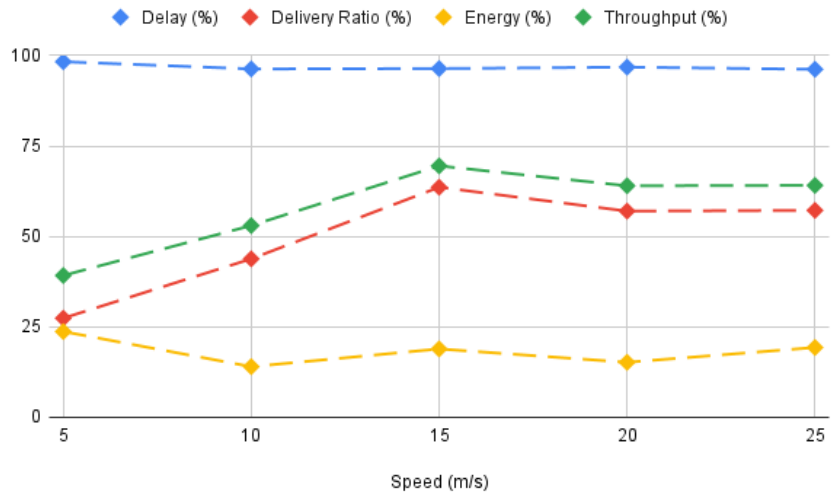

Fig. 4: Percentagewise improvement of routing for varying the speed

Even when traffic levels rise, this proposed approach can identify the optimal route, throughput, and network to reduce latency, ensuring that each machine receives packets sooner than expected. In mobile ad hoc networks, it's recommended to use a secure and trusted routing algorithm to secure the safest path while maximizing bandwidth, throughput, and minimizing energy use and routing overhead, all while preventing packet delays.

Conclusion

To make sure messages get delivered on time, ad hoc network routing techniques focus on creating a clear and efficient path between two nodes. The goal is to build routes that use the least bandwidth and overhead possible. However, path failures are pretty common in these networks due to limitations in power, transmission range, and mobility. Localization is a bit of a paradox; it involves figuring out the location of hubs in environments that are still unknown. In a foundation-less system, localizing these hubs meets several needs. The techniques used for localization are incredibly useful for both wired and wireless networks, including ad hoc networks. If we could just pinpoint the actual locations of the hubs, many issues related to security and routing could be resolved. Being aware of these locations is crucial for fully leveraging the benefits of universal computing. To achieve this, various localization algorithms are

introduced to determine the positions of mobile nodes (MNs). The location data obtained from these algorithms can be incredibly valuable for accessing a range of location-based services, such as tracking, habitat monitoring, rescue operations, and real-time visitor management, among others.

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