

Dynamic Adaptive Routing Protocol for Wireless Networks

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Abstract:

Wireless networks, especially Mobile Ad Hoc Networks (MANETs), suffer from frequent topology changes and limited resources. Traditional routing protocols are not efficient under dynamic conditions. This paper proposes a Dynamic Adaptive Routing Protocol (DARP) that adjusts routing decisions based on mobility, link stability, and traffic load. The proposed system improves packet delivery ratio and reduces routing overhead.

Keywords: MANET, Routing Protocol, Adaptive Routing, AODV, DSR, Wireless Networks.

1. INTRODUCTION

Wireless communication has become an essential part of modern technology. Mobile Ad Hoc Networks (MANETs) are self-configuring networks without fixed infrastructure. Nodes communicate dynamically and act as routers.

Due to node mobility, routing becomes a challenging task. Traditional routing protocols fail to perform efficiently in dynamic conditions. Therefore, adaptive routing techniques are required.

This paper focuses on designing a routing protocol that adapts dynamically to network conditions to improve performance metrics such as throughput, delay, and packet delivery ratio.

II. LITERATURE REVIEW

Various routing protocols have been proposed for MANETs. These include proactive, reactive, and hybrid protocols. AODV is a reactive protocol that establishes routes on demand but suffers

from delay during route. DSR uses source routing but is not scalable. DSDV maintains routing tables but creates high overhead.

Research shows that adaptive routing techniques can improve performance by considering network parameters such as mobility and traffic conditions.

III. PROBLEM STATEMENT

Existing routing protocols face several challenges:

1. Frequent route failures due to mobility
2. High routing overhead
3. Increased packet loss
4. Lack of adaptability

These limitations reduce network performance, especially in highly dynamic environments.

IV. PROPOSED SYSTEM

The proposed Dynamic Adaptive Routing Protocol (DARP) is designed to enhance routing efficiency in wireless networks by dynamically adapting to changing network conditions. Unlike traditional routing protocols, DARP utilizes real-time network parameters to select the most optimal routing path.

The protocol continuously monitors key network metrics such as node mobility, link stability, and traffic load. Based on these parameters, it intelligently switches between different routing strategies to maintain reliable communication and improve overall network performance.

Key features:

- Dynamic route selection
- Consideration of link stability
- Traffic-aware routing

The system continuously monitors network conditions and updates routing decisions accordingly.

V. METHODOLOGY

The proposed methodology for the Dynamic Adaptive Routing Protocol (DARP) is designed to ensure efficient and reliable routing in dynamic wireless network environments. The approach consists of multiple stages that continuously monitor network conditions and adapt routing decisions accordingly.

Step 1: Data collection from network nodes

In this phase, real-time data is collected from all participating nodes in the network. The parameters include node mobility (velocity), residual energy, link strength, and traffic load. These parameters provide a comprehensive view of the current network state.

Step 2: Analyze node mobility and link strength

The collected data is analyzed to determine the stability of nodes and communication links. High mobility nodes are identified as less reliable, while links with strong signal strength and longer duration are considered more stable for routing.

Step 3: Assign weights to routes

Each possible route is assigned a composite weight value based on multiple factors such as:

- Link stability
- Node mobility
- Traffic congestion
- Energy availability

A weighted scoring mechanism is used to evaluate the suitability of each route.

Step 4: Select optimal route.

Based on the computed weights, the protocol selects the most optimal route that ensures:

- Minimum delay
- Maximum reliability
- Balanced network load

The decision-making process may use rule-based or adaptive logic techniques.

Step 5: Update routes dynamically.

The system continuously monitors the network and updates routing decisions whenever

significant changes occur (e.g., node movement, congestion, or link failure). This ensures that the routing path remains optimal throughout the communication process.

This methodology enables the DARP system to adapt dynamically to changing network conditions, resulting in improved performance in terms of packet delivery ratio, latency, and network efficiency. This approach ensures efficient routing under changing conditions.

VI. PERFORMANCE METRICS

The performance of the proposed Dynamic Adaptive Routing Protocol (DARP) is evaluated using standard network performance metrics. These metrics help in analyzing the efficiency, reliability, and scalability of the routing protocol under varying network conditions.

The system is evaluated using:

1. Packet Delivery Ratio (PDR)

Packet Delivery Ratio represents the ratio of successfully received data packets to the total number of packets sent by the source.

$$PDR = \frac{\text{Total packets received}}{\text{Total packets sent}}$$

Higher PDR indicates better reliability and efficiency. Ideal value is close to 1 (or 100%)

2. End-to-End Delay

End-to-End Delay is the average time taken by a data packet to travel from source to destination.

$$\text{Delay} = \frac{\sum(t_{\text{receive}} - t_{\text{send}})}{\text{Total number of packets}}$$

3. Throughput

Throughput measures the rate of successful data delivery over the network, usually expressed in bits per second (bps).

$$\text{Throughput} = \frac{\text{Total data received (bits)}}{\text{Total simulation time}}$$

Higher throughput indicates better network performance

4. Routing Overhead

Routing Overhead represents the extra control packets generated for routing compared to actual data packets transmitted.

$$\text{Routing Overhead} = \frac{\text{Control packets}}{\text{Data packets}}$$

Lower overhead indicates efficient routing protocol. High overhead leads to network congestion. These metrics help in analyzing the effectiveness of the proposed protocol.

VII. RESULTS AND DISCUSSION

The performance of the proposed Dynamic Adaptive Routing Protocol (DARP) was evaluated through simulation and compared with conventional routing protocols such as AODV and OLSR. The evaluation was carried out using standard performance metrics including Packet Delivery Ratio (PDR), End-to-End Delay, Throughput, and Routing Overhead.

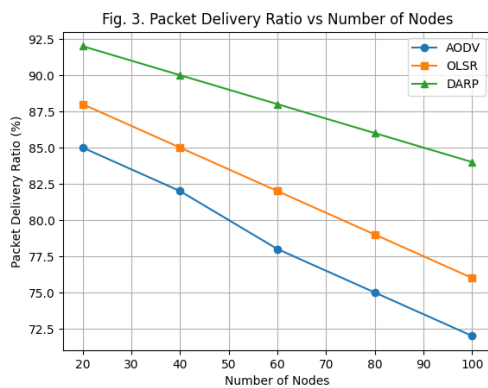


Fig. 1. Packet Delivery Ratio vs Number of Nodes

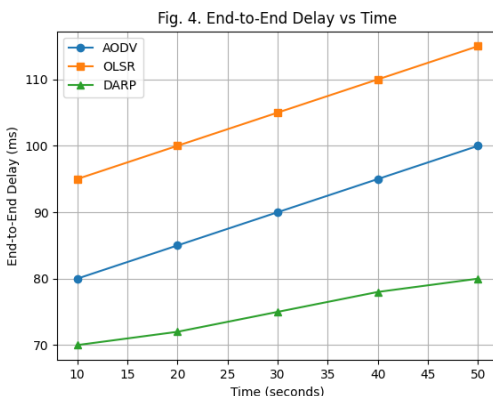


Fig. 2. End-to-End Delay vs Time

The simulation results, as illustrated in Fig. 1 and Fig. 2, demonstrate that the proposed DARP protocol consistently outperforms traditional routing approaches under varying network

conditions." Simulation results show that DARP performs better than traditional protocols.

Advantages:

- Higher packet delivery ratio
- Reduced delay
- Lower routing overhead

The adaptive nature of the protocol improves performance in dynamic environments.

VIII. CONCLUSION

This paper presents a Dynamic Adaptive Routing Protocol for wireless networks. The proposed system improves network performance by adapting to changing conditions.

Future work includes real-world implementation and optimization for energy efficiency.

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