

## SELF-AWARE DYNAMIC ROUTING IN WIRELESS SENSOR NETWORKS

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### Abstract:

Delay in Wireless Sensor Networks has negative impact on the performance, namely, decreased throughput and increased per-packet energy consumption. In wireless sensor network, when congestion occurs in the intermediate level, the forwarding node takes the load status about its neighbors into account in order to scatter the excessive packets, an appropriate detour path consisting of idle or under loaded nodes can be found purposely. But the detour path takes large end-to-end delay. The existing method used the centralized approach and it consumes more energy. In proposed method, node is self-aware about the network. Pre-network analysis taken place at the starting stage. Hence the forwarding node checks status of the nearest node capability with the help of AODV algorithm before forwarding packets. This results in reduction of delay of overall traversing and congestion at each node. Moreover, throughput of the overall network also increased. Finally, we demonstrate the effectiveness of our solution with simulations on NS2.

**Index Terms**- Wireless Sensor network, self-aware, AODV, NS2, Dynamic Routing.

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## **I. INTRODUCTION:**

Wireless sensor networks are becoming very popular in both industrial and home automation applications. A typical wireless sensor network consists of a large number of small-sized, battery-powered sensor nodes that are limited in battery energy, CPU power, and communication capability. Congestion control involves two factors that measure the performance of a network: delay and throughput.

### **A. DELAY VERSUS LOAD**

Note that when the load is much less than the capacity of the network, the delay is at a minimum. This minimum delay is composed of propagation delay and processing delay, both of which are negligible. However when the load reaches the network capacity, the delay increases sharply because we now need to add the waiting time in the queues (for routers in the path) to the total delay. Note that the delay becomes infinite when the load is greater than the capacity.

If this is not obvious, consider the size of the queues when almost no packet reaches the destination, or reaches the destination, or reaches the destination with infinite delay; the queues become longer and longer. Delay has a negative effect on the load and consequently the congestion. When a packet is delayed, the source, not receiving the acknowledgment, retransmits the packets, which makes the delay, and the congestion, worse.

### **B. THROUGHPUT VERSUS LOAD**

We defined throughput and as the number of bits passing through a point in a second. We can extend that definition from bits to packets and from a point to a network. We can define throughput in a network as the number of packets passing through the network in a unit of time. Notice that when the load is below the capacity of the network, the throughput increases proportionally with the load. We expect the throughput to remain constant after the load reaches the capacity, but instead the throughput declines sharply. The reason is the discarding of packets does not reduce the number of packets by the routers. When the load exceeds the capacity, the queues become full and the routers have to discard some packets. Discarding packets does not reduce the number of packets in the network because the sources retransmit the packets, using time-out mechanisms, when the packets do not reach the destinations

## II. RELATED WORK:

Several researchers have done the qualitative and quantitative analysis of Ad Hoc Routing Protocols by means of different performance metrics. They have used different simulators for this purpose. J Broch et al. [1] performed experiments for performance comparison of both proactive and reactive routing protocols. In their simulation, a network size of 50 nodes with varying pause times and various movement patterns were chosen. The simulation was done with ns-2 simulator. A related innovative network layer approach to robust routing that takes unique advantage of the broadcast wireless channel for diversity is the extremely opportunistic routing technique.

Unlike traditional routing techniques, in ExOR the identity of the node, which is to forward a packet, is not pre-determined before the packet is transmitted. Instead, it ensures that the node closest to the destination that receives a given packet will forward the packet further. While this technique does not explicitly use metric-based routing, the protocol is designed to minimize the number of transmissions as well as the end-to-end delay. ExOR also requires a larger set of receivers to be active, which may have an energy penalty.

## III. BASIC ROUTING ALGORITHM:

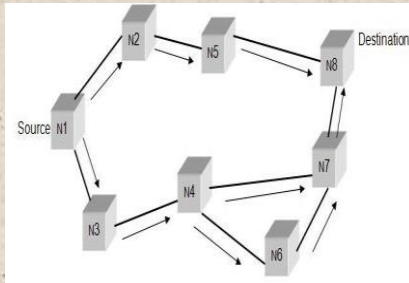
### Description of Proposed AODV Scheme

Ad hoc On Demand Distance Vector (AODV) initiates a route discovery process only when it has data packets to send and it does not know any route to the destination node, that is, route discovery in AODV is “on-demand”. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers.

#### A. Route Establishment

In an on-demand routing protocol, the source node floods the route request packet in the network when a route is not available for the desired destination. It may obtain multiple routes to different destinations from a single route request.





**Fig.A.** Route Establishment

### *Update path information*

A node updates its path information only if the destination sequence number of the current packet received is greater than the last destination sequence number stored at the node.

### *Nodes calculation in the network*

Let 'n' be the number of nodes in the network,

$$N(n) = \sum n.P_n$$

$$N(n) = \sum n (\lambda/\mu)^n \{1 - (\lambda/\mu)\} \quad (1)$$

### *Nodes in the network except source node*

$$N(n-1) = \{1 - (\lambda/\mu)\} \sum (n-1) (\lambda/\mu)^n \quad (2)$$

$\lambda$  – Arrival rate

$\mu$  – Path established rate

### **B. Route Maintenance**

If a path break is detected at an intermediate node, the node informs the end nodes by sending an unsolicited Route reply with the hop count set as  $\infty$ .

#### IV. WORKING STEPS:

In the first step, pre-network analysis taken place. After that number of nodes available is calculated with the help of the formula (2). Hence, the source node floods the route request packets through the various routes for communication establishment. After that the routing node checks the nearest node capability, whether the node is free or not. If free, forward the packets to the destination through intermediate nodes. If no means the pre-network analysis is repeated.

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A route request carries the source identifier (SrcID), the destination identifier (DestID), the source sequence number (SrcSeqNum), the destination sequence number (DestSeqNum), the broadcast identifier (BcastID), and the time to live (TTL) field. Destination sequence number indicates the freshness of the route that is accepted by the source. When an intermediate node receives a route request, it either forwards it or prepares a route reply if it has a valid route to the destination. The validity of a route at the intermediate node is determined by comparing the sequence number at the intermediate node with the destination sequence number in the route request packet.

If a route request is received multiple times, which is indicated by the BcastID-SrcID pair, the duplicate copies are discarded. All intermediate nodes having valid routes to the destination, or the destination node itself, are allowed to send route reply packets to the source. Every intermediate node, while forwarding a route request, enters the previous node address and its BcastID. A timer is used to delete this entry in case a route reply is not received before the timer expires. This helps in storing an active path at the intermediate node as AODV does not employ source routing of data packets. When a node receives a route reply packet, information about the previous node from which the packet was received is also stored in order to forward the data packet to this next node as the next hop toward the destination.

V **SIMULATON SETUP:**

Here we give the emphasis for the evaluation of performance of Ad Hoc routing protocol AODV with varying the number of sensor nodes. The simulations have been performed using network simulator NS-2 version 2.34 running on Fedora 7 is an open source discrete event simulation tool, which means it simulates events such as sending, receiving, forwarding and dropping packets.

Table 1: Parameters values for AODV simulation

Simulator	Ns-2.34
Protocol	AODV
Simulation duration	250 seconds
Simulation area	1500 m X 1500 m
Number of nodes	2,4,6,8,10
Transmission model	250m

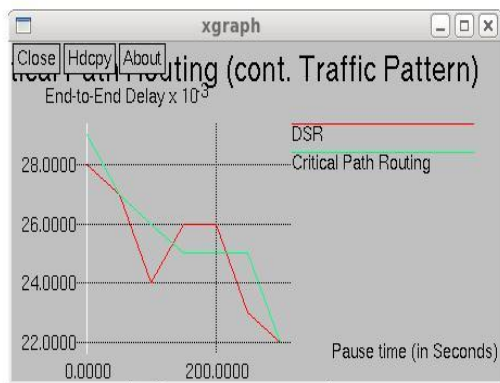


Figure 1. Evaluation graph (1)



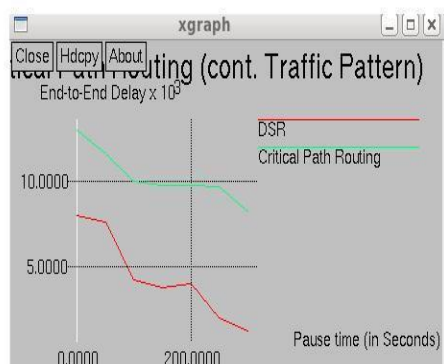


Figure 2. Evaluation graph (2)

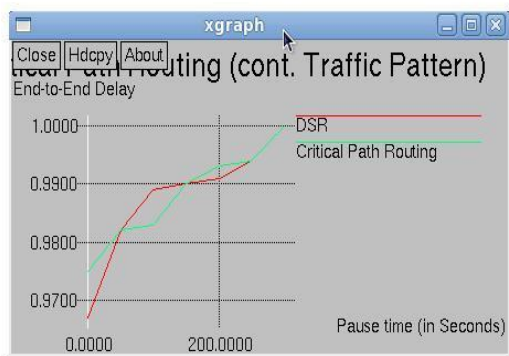


Figure 3. Performance graph

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