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A Survey on DSDV Node Design in Wireless Ad Hoc Networks

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Abstract **-** Wireless ad hoc network play an important role in communication devices used in numerous applications. Wireless ad hoc networks consist of ad hoc nodes that are used to gather data about a target or event, and to provide a variety of sensing and monitoring applications. Each node in a ad hoc networks acts as a router, forwarding data packets to other nodes. Without routing protocols, these routers cannot work together in phase. In this energy consumption is the most important criterion and low power electronic devices are used in it. There are many routing protocols namely DSDV (Destination Sequence Distance Vector), AODV (Ad-hoc On Demand Distance Vector), and AOMDV (Ad-hoc On Demand Multiple Distance Vector). In this paper, we have analyzed DSDV routing protocols in wireless ad hoc network scenarios. In addition relevant issues and challenges in the field are subsequently illustrated and discussed.

Keywords— DSDV, Wireless ad hoc, Wireless Personal Area network, Wi-Fi and Bluetooth.

I. INTRODUCTION

The telecommunication industry focus on current telephone network according to the future generation resulted in technological innovations through digitalization in telecommunication. These innovations are dropping cost and supports new devices and applications. Two of those in which researchers are trying to find out applications are Radio Frequency Identification (RFID) and Wireless Personal Area Networks (WPANs). Some of the areas of RFID applications are transport, buildings, tollbooths etc. Its main advantage is to reduce the cost of manpower, consistent and a quality system and drawback is barcodes it generally need line of site to recognize the object. But RFID doesn't need it and the location of the object could be tracked without any physical appearance [1]. In WPAN the applications used in medical field, provides precious information by sensing parameters like sound, pressure, temperature and anything it senses using ad hoc. We can create own network in ISM band which makes this application cost effective. Routing protocol plays a major part in communication process. Routing in a ad hoc network requires that routing protocol must reduce network energy dissipation and make best use of network lifetime. DSDV is a proactive routing protocol and is based on the idea of the Bellman-Ford Routing Algorithm with certain improvements. It was developed by C. Perkins and P. Bhagwat in 1994 [2].The main contribution of this algorithm was to solve the routing loop problem.

II. RFID AND WPANS

The integration of RFID with WPAN technology will give way to numerous new application and benefits which are discussed below.

A. Cost Effective

RFID with WPAN reduces work cost. Embedded RFID with WPAN is capable of identifying any particular location even remote places where appointing manpower to collect data is tedious. This reduces the labor cost. Also money investment is needed only during installation, and then it becomes a free network where collection of data is free of cost [3].

B. Mobility

The integration of these two technologies extends the application. Through node to node network it becomes mobile, portable, easy to install anywhere without any connection with other systems and offers free collection of data. For example, if there is a wired network to collect data like attendance in college, the replacement of the server room requires the jam of the whole RFID network. But our system doesn't require this as it is mobile and portable.

III. ROUTING PROTOCOL

Router selects the route between nodes, communicates and spreads the information by sending data and control packets. Immediate neighbors will have knowledge in prior about the routers. By this, the routers will know the way in which the Path is made. Other techniques for routing in ad hoc network are flooding and gossiping.

A. Flooding

In Flooding, the given node will broadcast data and control packets to all the remaining nodes in the network till the destination node is found or reached. This makes the technique blind that duplicating packets might get circulated and received. This problem is called as Implosion.

B. Gossiping

Gossiping was introduced to overcome the problem in flooding where data and control packets are broadcasted to all by the given node. So that in Gossiping, A ad hoc network would randomly select one of its neighbors and then sends the data and packet to it. This rectifies Implosion as each node can receive only one copy of the packet being sent.

IV. DESIGN ISSUES OF ROUTING PROTOCOL

For the efficient communication in Wireless Adhoc Network, the below problems should be rectified.

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A. Node Deployment

The Node Deployment affects the routing either by Deterministic or Randomized manner. In Deterministic node Deployment, the paths will be already Pre-Determined and data will be routed through it where adhoc placed. In Random node Deployment, the ad hoc nodes will be scattered in a random manner.

B. Power Consumption

Direct Routing sends signals directly to the Destination in a network of one single pathway. Multi-hop routing involves sending signals through multiple stops instead of one long pathway as in direct routing. In the presence of obstacles in the broadcasting of wireless radio; MULTI-HOP routing consumes less energy than direct routing. The broadcast power of a wireless radio is comparative to distance squared. Direct Routing will be good if all the nodes are very close to the sink node. Node lifetime is dependent on battery lifetime. Ad hoc nodes will be equipped with the power source of (0.5 Ah 1.2V).

C. Data Delivery Model

Data collected by the nodes will be delivered by seeking the dependence on the application of the ad hoc network. The Data Delivery model can be Continuous, Event-Driven, Query- Driven or Hybrid.

- Continuous- the ad hoc delivers or transmits the data it has, with regular intervals of time.
- Event-Driven- At first an event occurs and that event drives the data to get transmitted ad hoc.
- Query- Driven- Ad hoc transmit only when the query is generated and the query drives it.
- Hybrid- It is a combination of continuous, event and query-driven models.

D. Link Heterogeneity

Homogeneous nodes includes similar type of nodes, it has varied type of applications in WSN. Heterogeneous nodes include varied type of adhoc nodes. To improve the characteristics of the ad hoc node with different processors, transceivers and power units are used. Benefit of heterogeneous node includes scalability of the network, energy drainage or bandwidth.

E.g.: Hierarchical protocol will have both Cluster-head nodes and also normal adhoc. Cluster-heads are more powerful in terms of energy, bandwidth and memory compared to ad hoc nodes.

E. Fault Tolerance

The Routing Protocol could be affected by the failure of ad hoc nodes. And the failure may be due to lack of power, physical damage or environmental interference. If the failure occurs the Routing Protocol must find new path to the data collection base stations. This requires actively adjusting transmitting powers, rerouting packets through the regions of the network.

V. NETWORK DYNAMICS

Most of the network architectures assume that ad hoc nodes are stationary.

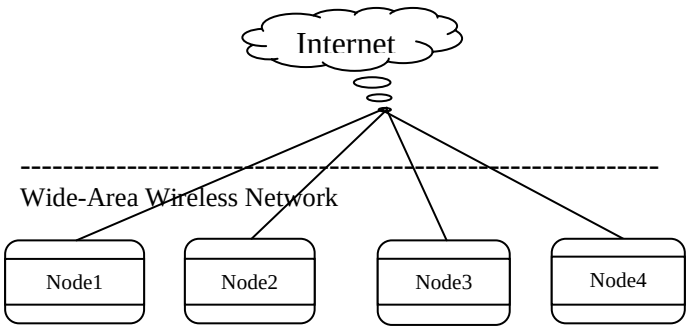

Figure 1: **Network Architecture**

However, mobility of either BS's or ad hoc nodes is now and then necessary in many applications. Routing communication from or to moving nodes is more demanding since route stability becomes an vital issue, in addition to energy, bandwidth etc. Moreover, the sensed phenomenon can be either dynamic or static depending on the application, e.g., it is dynamic in a target detection/tracking application, while it is static in forest monitoring for early fire prevention. Monitoring static events allows the network to work in a reactive mode, simply generating traffic when reporting[7]. Dynamic events in most applications require periodic reporting and consequently generate significant traffic to be routed to the BS.

A. Broadcast Media

Wireless medium are linked by a communicating nodes in multi-hop ad hoc network. The traditional problems associated with a wireless channel (e.g., fading, high error rate) may also affect the operation of the ad hoc network. In general, the required bandwidth of ad hoc data will be low, on the order of 1-100 kb/s. Related to the transmission media is the design of Medium Access Control (MAC). One approach of MAC design for ad hoc networks is to use Time division multiple access (TDMA) based protocols that conserve more energy compared to contention based protocols like CSMA. Bluetooth technology can also be used [7].

B. Operating Environment

In WSNs, each ad hoc node obtains a certain view of the environment. A given ad hoc's view of the environment is limited both in range and in accuracy; it can only cover a limited physical area of the environment. Hence, area coverage is also an important design parameter in WSNs.

C. Data Latency And Overhead

These are considered as the important factors that influence routing protocol design. Data aggregation and multi-hop relays cause data latency. In addition, some routing protocols create excessive overheads to implement their algorithms, which are not suitable for serious energy constrained networks.

D. Autonomy

The assumption of a dedicated unit that controls the radio and routing resources does not stand in wireless ad hoc networks as it could be an easy point of attack. Since there will not be any centralized entity to make the routing decision, the routing procedures are transferred to the network nodes [7].

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VI. CLASSIFICTION OF ROUTING

Routing is the process of selecting best paths in a network. And the Routing protocol specifies how routers communicate with each other by selecting routes between any two nodes on the network and spreads information.

To classify Routing Protocols certain characteristics are taken into consideration. They are

- Routing Technique-The Routing of data (selecting best paths) happens through Routing Technique
- Route Establishment Procedure-And the Route (Best Path) is established by Routing Protocols like Proactive, Reactive, Hybrid
- Protocol Operation-It tells whether the Routing protocol offers multiple path rather than a single path to be ready for Fault tolerance, as if one path fails we can proceed with the next.
- Network structure

A. Proactive

The Path of Routing is pre-set in proactive protocol even before the need for it arises. Paths are maintained even there is no traffic flow at that time. In reactive routing protocol, the data to be sent, Queries are initiated which actually triggers the routing and setup the path for transmission. Routing happens because of the query generated. The last group consists of hybrid protocols which is combination of both proactive and reactive protocol. Routing protocols are also classified based on whether they are destination-initiated (Dst-initiated) or source-initiated.

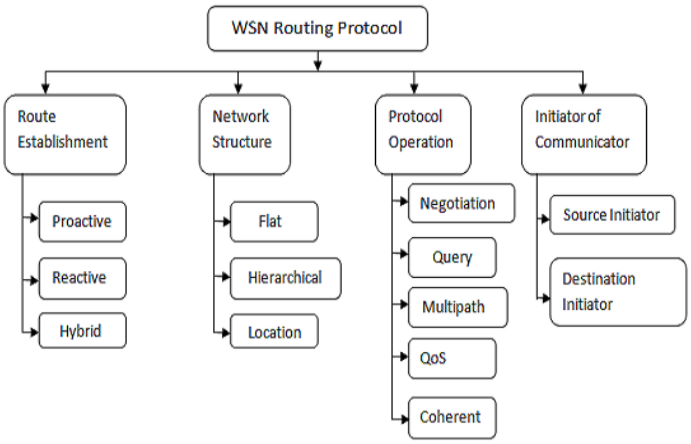

Figure 2: **Routing Protocol Architecture**

For spreading of information from one node to another as throughout the network each node will have one or more tables and those tables contain information about all the nodes and the route to reach it in the network. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth [9]. Examples of such schemes are the conventional routing schemes, Destination Sequenced Distance Vector (DSDV).

B. Reactive Protocol

These protocols do not maintain routing information or routing activity at the network nodes if there is no communication. If a node wants to send a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packet. The route discovery usually occurs by flooding the route request packets throughout the network. Example of reactive routing protocol is ad hoc on-demand distance vector routing (AODV). Hybrid protocols use both reactive and proactive Mechanisms.

C. Hybrid Protocols

Hybrid protocols can be divided into two groups. The first group does not transmit any routing information if no route is required. Only the source and the destination of an active route periodically transmit routing information in order to keep the existing routes up-to-date. The advantage of this approach compared to reactive strategies is that the routing protocol is able to quickly detect link breaks in active routes. The second group of hybrid protocols uses proactive routing mechanisms for short range communication and reactive routing techniques for long range communication [10]. Thus, they use periodic broadcast mechanisms to establish and maintain routes to nodes which are reachable within two or three hops.

D. Protocol Operation

Routing protocols can be also categorized with respect to their protocol operation. This kind of categorization has the advantage of being more application oriented compared to the two previously discussed taxonomies. In the following, the protocols are distinguished in negotiation-based and query-based protocols. Moreover, the protocols are grouped whether they offer multi-path or QoS support and depending on the used data processing technique. However, the protocol-based classification is not as strict as the other classifications. Thus, a routing protocol may fit into more than one category.

VII. DESTINATION-SEQUENCED DISTANCEVECTOR ROUTING (DSDV)

The DSDV routing algorithm is built on top of Bellman-Ford routing algorithm. There are two routing algorithms available. First one is Link-State algorithm each node maintains a view of the network topology and second one is Distance-Vector algorithm where every node maintains the distance of each destination. Distance-Vector algorithm is not suited for ad-hoc networks because it causes loops and count-to-infinity problem. The solution is to using DSDV protocol which is Destination Based and contains no global view of topology. In DSDV each node maintains routing information for all known destinations and routing information must be updated periodically. The route labeled with the highest sequence number is always used. This also helps in identifying the stale routes from the new ones, thereby avoiding the

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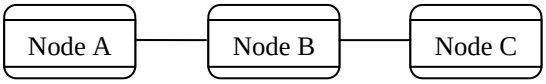
formation of loops. DSDV allows fast reaction to topology changes. It makes immediate route advertisement on significant changes in routing table but waits with advertising of unstable routes.



For example the routing table of Node A in this network is

Destination	Next Hop	NoOf Hops	Sequence No	Install Time
A	A	0	A46	001000
B	B	1	B36	001100
C	C	2	C28	001300

Table 1**: Increamenting Sequence Number Using DSDV**

Obviously the table contains report of all possible paths reachable by node A, along with the next hop, number of hops and sequence number. The maintained list which is called routing table. The routing table contains the following [10].

(1) All available destinations' IP address
(2) Next hop IP address
(3) Number of hops to reach the destination
(4) Sequence number assigned by the destination node
(5) Install time

If a node is no more reachable (timeout) then DSDV increases sequence number of this node by 1 (odd sequence number) and set metric = ∞.To minimize the traffic generated, there are different types of packets in the system. "Full dump" is one of the packet, which have the information about the change [11].The "incremental" is the another type of packet, which have the information about the overall system efficiency.

A. Path Discovery Process

Path Discovery Process is performed by Source node S which initiates the process. This process happens by, *Route Request (RREQ), which contains*

- Source Address
- Source Sequence Number
- Broadcast-id Number.
- Destination-Address
- Destination Sequence Number
- Hop-Address

To find the Destination, Source Node sends the RREQ to all the Nodes, which is again sent to all others till the path, is found through Route Reply (RREP). Every node maintains Sequence Number, Broadcast-id Number and it is incremented for every RREQ the Source Node initiates.When a node forwards the RREQ message to its neighbor it records the address from whom it received for the maintenance of reverse path from the Destination to the Source.

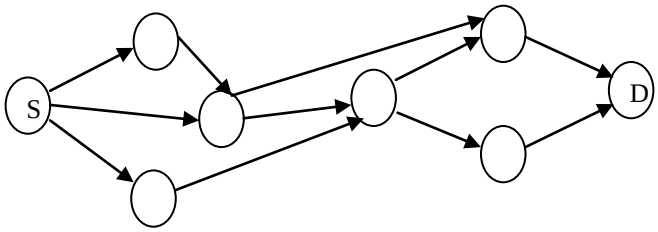


Figure 3: **Multiple Path for sending packets**

The Path discovery is initiated by the Source node S. The address of the next from which it receives the first copy of the broadcast packet is recorded when node forwards the RREQ message, in order to track the reverse path to the source node.

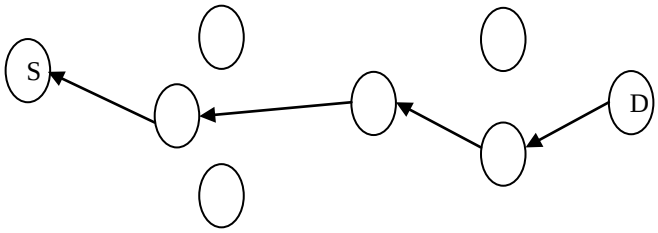


Figure 4: **Packet is sent back to the source**

RREQ contains source address, source sequence number, broadcast_id, destination address, destination sequence number and hop count broadcast_id. When source issue RREQ the broadcast_id will be incremented. The route expiration technique uses the AODV when routing table entry expires.

B. Simulation Model

The fixed number of packet sizes (512-bytes) will be used in experiments. The mobility model used is a radio propagation model. The field configurations used is 500m X 500m with different number of nodes. Here, each packet starts its journey from a random location to a random destination with a randomly chosen speed. Simulation runs for 100 simulated seconds. Identical mobility and traffic scenarios are used across protocols to gather fair results.

Channel type	**Wireless**
Network Interface type	Physical wireless
Routing protocol	AODV (NS2 default) and DSDV(NS-2 default)
Queue Length	50 packets
Number of nodes in topography	10, 20, 40, 80
Simulation end time	400 seconds
Traffic Type	TCP
Speed	40m/s
MAC protocol	IEEE 802.11
Packet Size	512 Bytes

Table .2 **Simulation Configuration**

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C. Disadvantages

During idle state small amount of bandwidth and battery power is used for updating the routing table in DSDV. The new sequence number is compulsory when the network changes happen in topology before the network re-converges; thus, DSDV is not suitable for highly dynamic or large scale networks.

VIII. PERFORMANCE COMPARISON AND ANALYSIS

In Performance Comparison and analysis PDF and average end-to-end delay is compared for better outcome.

A. Packet Delivery Fraction (PDF)

In Packet delivery fraction the constant bit rate (CBR) traffic sources was generated by the delivered packets. The PDF demonstrate how successful protocols carry out delivering packets from source to destination. The higher value gives the better outcome. This metric characterizes both the completeness and correctness of the routing protocol also consistency of routing protocol by giving its effectiveness [12].

B. Average End-To-End Delay

The buffering which happens at the time of the route discovery will be included in metric, queuing delay happen due to waiting at the interface queue, and retransmission delays at MAC. The ratio of the time difference between the packet and delivery time of the packet is known as propagation and transfer times.

IX. CONCLUSION

In this paper the benefits of integrating RFID with WPAN are discussed in detail. The design issues of routing protocol and network dynamics are explained in detail. To understand the routing protocol different classification of routing and routing architecture are also explained. The DSDV algorithm which exists over a period of time and has many disadvantages therefore a better technique SDFRP will be implemented in future work.

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