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Reactive Routing Protocol AODV Based on Wireless Sensor Networks

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Abstract: The wireless sensor networks can help people with the data collection in kinds of special environments and do special production and operation. But the transformation in WSNs is obviously passive. In order to get rid of this problem in the data transformation we have to bring in a kind of communication technology of routing protocol which can adapt well to the networks. The protocol AODV can overtake the topology change because its advantages of mass storage, simple algorithms and strong practicability. This kind of reactive routing protocol AODV is very fit for the characteristics of wireless sensor networks, and it also is a international recognized standard routing protocol which has been improved for several times. In this paper we firstly analyzed the adaptation and basic principle of AODV, then the problems faced in the applications. At last we put forward the corresponding improving methods to make this protocol fully take its advantages. *Copyright © 2013 IFSA.*

Keywords: Wireless sensor networks, Network characteristics, Reactive route, AODV protocol.

1. Introduction

1.1. The Wireless Sensor Networks

Wireless sensor network (WSN) is a kind of new network mode, wireless sensor network (WSN) by a perception, calculation ability and communication ability of a large number of tiny sensor nodes. These sensors can sense the change of the surrounding environment and to collect the relevant environmental parameters, and the parameter information processing running collection point or base station, completing the data collection and [1]. In order to save energy consumption in transmission, the transmission distance of sensor node is limited, usually in the hundreds of meters, so once appear on the distance, the sensor must be using relay way of information transmission over a long distance, the sensor node will constitute a sensor network, information transmission was completed by multiple routing. So in long distance transmission, sensor nodes need to the data by using the method of multiple hops relay through multiple route back to the convergence of sensor node or base station [2].

Wireless sensor network can emulate traditional AD hoc network in the network, but most of the traditional network protocol algorithm has cannot be applied to the wireless sensor network (WSN), so you must with the help of a new type of routing protocol to guarantee the transmission of the data, and to ensure that the information transmission network to realize efficient. This is the nature of the wireless sensor network and the traditional AD hoc network.

1.2. Communication Protocol Stack for WSNs

1.2.1. Physical Layer

The physical layer mainly related to the transmission way of media and modulation, such as radio transmission is a common way of delivery, so frequency band selection is the foundation of the transfer data, majority is the ISM band, can use a kind of multiple access mode to reduce the energy consumption of the whole system.

1.2.2. Data Link Layer

The data link layer is used to establish a reliable point to point or point to multipoint communication link, mainly involving the media access control (MAC) protocol. We chose to use the outcome of the research institute at the university of Berkeley S - MAC protocol [3], this level is to solve the point-to-point data transmission link build problems, main control access protocol, to ensure that the data transmission network optimization, using the competition agreement there is no need to schedule on local and global level, the communication between the sensor nodes, can be completed and occupied channel can be set reasonable time.

1.2.3. Network Layer

This layer is targeted at the level of communication protocol is defined, is to determine the address information and give the process of its logical addresses and physical addresses. Information from the source point to the target point can be determined the basic routing, and deal with related business issues. The most important function of network layer to data grouping, looking for the best path to complete information transmission, design on the network layer routing protocol can be determine the efficiency of the system transfer.

1.2.4. Applying Layer

The layer and is directly related to specific wireless sensor application environment, the need for reasonable design for specific applications. Application layer of the main task is to collect the relevant data and conduct a preliminary treatment, and then in the network to complete the transfer. According to the specific needs of data center get the address accordingly, so as to establish an effective network structure and complete information for the customer. At the application level the application level of the development and use different software. The application of wireless sensor network support services include: time synchronization and node localization [4].

2. Introduction of AODV Protocol

2.1. Application Significance of AODV in WSNs

In recent years, the mature AODV protocol has been gradually applied to the wireless sensor network (WSN), the protocol has similarities with the wireless network, in the process of research hotspot focused on a wireless network of sensor nodes under certain conditions is limited by energy, if you want to for a long time to maintain network function must take into account the efficient performance, must complete data transmission using less energy, and at the same time guarantee the network security. AODV protocol's advantage lies in its large capacity, the algorithm is relatively simple, practical and can adapt to topology changes, so the application and popularization in the wireless network. But most of wireless sensor network node is battery, so after it was arrangement form network node is not easy to be replaced, so AODV must first consider the wireless sensor can good question, so in many studies are of this kind of problem is discussed in this paper. It was highlighted the advantages of reactive routing protocols to build centralized consider introducing new routing mechanism and multipath mechanism, at the same time in the process of updating to consider the node energy consumption. To AODV protocol combined with wireless sensor network, and keeps the long time of network flow and transmission efficiency. This is the AODV application and the significance of wireless sensor network.

2.2. Advantages of AODV

AODV support intermediate node response to each other, can help the network efficiency, in the shortest possible time to complete the active path of broken chain; Node only needs to be routing, save storage complexity is reduced greatly, reduced the restrictions on node memory, thereby reducing the relatively complicated with a large number of replication, according to the characteristics of wireless sensor node storage ability very comfortable; Properties of AODV is a reactive routing, just need to keep the adjacent nodes of information, the calculation method of routing is relatively short answer, routing algorithm is relatively practical, routing efficiency is very high at the same time, to adapt to the wireless sensor node if the characteristics of the computing power; The application of the destination node can avoid the occurrence of routing loops, solve the traditional mechanism based on distance vector routing protocol of infinite counting problems; AODV protocol for wireless sensor network node to the demands of fixed point is used to, when network topology decoupling shares changed just need to inform the nearest node, network maintenance cost is low.

The large number of wireless sensor network node, the distribution environment is relatively complex, so in general position of the sensor node is relatively fixed, so nodes run and cause cut-off condition is not easy to appear. Wireless sensor network status and single processing power and storage space, energy is limited, some sensor network poor working conditions at the same time, once the layout of the site maintenance is very difficult, so the equation of AODV protocol is very suitable for wireless sensor network characteristics. Routing protocol and its protocol is internationally recognized standard, after a lot of improvement has been very mature, so it combine with wireless sensor network (WSN) use can play its technical advantages.

2.3. Realization of AODV Protocol

In the application of the AODV protocol, reference is the DSR protocol model based routing and routing maintenance procedure, and the serial number to write and DSDV by hop routing update mechanism maintenance phase of the cycle, in order to reduce routing in the operation of the radio frequency, AODV protocol established a reaction mechanism, as mentioned earlier routing [5]. AODV advantage is, it does not need to be in the process of implementation group includes an event source routing, which reduces the routing protocol overhead, so not in the path in which the agreement within the node does not need to exchange, to participate in the routing is not preserved routing information. If the sensor node unexpected situation, requires the transmission of information to be gathered and then to complete the analysis of the data. AODV protocol can achieve a spontaneous mechanism between the nodes, the change of dynamic routing paths, which quickly response to the dynamic change of chain scission, and make corresponding adjustment. AODV routing is a kind of loop form, can be safely to avoid the problem of infinite count in traditional algorithm, at the same time also can realize fast convergence. Purpose AODV routing table USES a serial number, serial number by the destination node is created, and sent to the data source node by its use, through the use of the purpose of serial number can avoid the loop. AODV protocol using three kinds of messages for the RREQ, RREP, RERR. AODV protocol is divided into discovery and maintenance process in the implementation.

2.3.1. Route Discovery

Route discovery process has two links, one is the source node routing discovery, intermediate node and destination node discovery process, specific see: if the source node and destination node information needed, if the corresponding routing is the path of the existing AODV is to accommodate after operation can complete the communication and data transmission. If you need to complete communication docking with the new destination node, the source node initiated the routing discovery process, through broadcast control information RREQs to find new route. Unitized RREQ will contain an ID, source node and destination node IP address, serial number, serial number, the hop, control, labeling, etc. The ID is the only a sign of recognition, degree of old and new serial number represents the packet, and hop count is used to save between source node and destination node after node number. In the RREQ information is passed to the destination node or a new intermediate node, the routing is determined. Determine whether the new node is using the serial number to identify. Such as RREQ information reaches the destination node or have arrived at the new path of the destination node, there will be a RREP message. RREP information contained with serial number, source node and destination node IP, cycle properties, hop and control. After receive the RREP intermediate nodes will increase the hop, including until positive routing data source node, and two-way data transmission.

2.3.2. Route Keep in

AODV protocol is selected in the application of distributed model, its operation is based on the routing table, each routing nodes in the routing process, after the confirmation of the list items are carried out to maintain routing and routing management responsibilities, need to keep in the routing table a for destination node address of the project, then implement step by step. In the process of maintain routing tables, once appear, fault point, the node will delete the related routing table project, at the same time to detect an active routing jump occurred in the situation, in order to keep the connection information, each node according to the cycle in the AODV protocol sends HELLO message around a certain node routing unicom recently, once appear, routing circuit will send a RERR message until the next adjacent active node, to keep the connection. In the RERR control information will lead to information for open circuit to transfer to the destination node. The node list will retain a precursor to help complete a function of the error, are stored in the list of this node is unable to be the next node information recently.

3. Improvement of Reactive Network Protocol AODV Based on WSNs

3.1. Problems in the Applications of AODV

Comprehensive look at AODV in the application of wireless sensor network can highlight its advantages, but in the actual application of AODV and its flaws, as is used in the wireless network

protocol technology in wireless sensor network (WSN) application must be properly improved to adapt to different network structure and demand, problems in the application of AODV are: protocol routing is established, in form and a link transmission over a period of time without exception, the path of the data source node sends data has been completely transmitted from the path, the formation of a state to keep the link, and the nodes on the link will consume large amounts of energy in maintaining phase, will appear in the network energy consumption high consumption area, if this keep for a long time, the node will consume too much energy on the link, so that the entire network is energy concerns, too much in the next transmission energy consumption of nodes will short-circuit threat exists, and leads to uneven energy and affect the service life of the network [6]. Second, if in the operation of the AODV protocol routing in invalid or short circuit connection problems, local is unable to handle in time, if you find fault node will be issued a RREP control information, at this point the control information will be transfer until she reached the route data source node, the data can be in accordance with the requirements of the RREP feedback, to stop the link of data transmission and data transmission, to find and link if repeat the above process is a very large network overhead, in view of the particularity of wireless sensor network hardware facilities, these problems will directly lead to the entire network running imbalance, resulting in network dysfunction. So must be improved to adapt to network requirements [7].

3.2. A kind of Improved AODV Protocol

3.2.1. Improvement of Routing Table

In accordance with the ideas to improve the original AODV routing table, on the basis of original increase a recognition field Energy, and set its value to the two, will Nexthop ID field, modified from the original one into two, the value of one to one correspondence with Energy. The improved routing table is shown in the Table 1.

Table 1. Improvement of routing for AODV.

Destination ID	Seqno	Hops	Nexthop ID (two value)	Energy (two value)	Timeout

3.2.2. Adjustment of the Routing Update Mechanism

In order to solve the AODV is applied to the wireless sensor network (WSN) a route to keep the normal length of time after application of the path of the energy consumption is too large, add a new path RRUP in improvement updates, including the use of control information to set the update of the routing path information, set in the update information is about the determination of node energy, in view of the nodes energy and the use cycle, limit, in the event of a long cycle of operating energy consumption is too large or case, the updates will issue related instructions by the path of change, choose a new path to complete relevant data transmission, the types of information including the node number, residual energy and other related information, and shall be carried out in accordance with the increase in the number of intermediate nodes and change, in order to control the running time of the path, realize routing updates on a regular basis [8, 9], that is, to the various nodes in the routing to keep hair send an update on a regular basis, intermediate nodes by the updated information will choose corresponding hop to compare two routes in the routing table of a smaller minimum hop count update path for reverse routing updates, so we can guarantee the network data transmission can maintain uninterrupted transmission, can also according to the operation requirements change routing path. In order to control the minimum path is occupied by a long time, so if the hop with one of the two routes in the routing table of the same hop count, chose RRUP in reverse updates give value is greater. If the base station receives RRUP may be carried out in accordance with the relevant control information reply, at this time the packet of basic information will be changed, so as to realize forward again, and positive path update command, the process is similar to nodes in front of the change. Design for the purpose of the routing update mechanism mainly is in the long run a balance of the energy of the wireless sensor network (WSN), not because the node residual energy difference is too large and cause in the operation of the entire network in a significant hidden danger, to some extent in order to prolong the life of the running of the whole system, its core idea is to use AODV protocol to help find process node selection, to complete the improvements on AODV.

3.2.3. The Introduction of Multipath Mechanism

In using the AODV protocol of wireless sensor network routing recovery help reduce delays in the process, can reduce the network to find routing and multiple hops routing overhead of RREP control information transmitted [10], on the basis of the original data of AODV, increase the two paths, this two days the path information stored in the

corresponding Nextgop ID respectively, the two paths are gained when establishing data source node to the RREQ made by request, intermediate nodes in the process of forwarding RREQ reach the destination node aggregation can be automatically obtained, thus the path of each intermediate node can only receive the first two consecutive RREQ before corresponding to two different hops ID number, and save it in a reverse current node in the routing table Nexthop ID field, the target receives the relevant information, the RREQ can according to before and after continuous received corresponding different one jump node ID number before send a corresponding RREP as routing reply packet, then in the process of routing nodes forward RREP its process and the RREQ is similar. Through the above process, most of the intermediate point in network will save two paths, the intermediate nodes can make a selection in the transmission, you can always get a minimum hop node as a transport path, complete the request of the source node. At the same time another path can be used as a backup, enable this address when link is abnormal, and at the time of local connection can't reply to reply path. Choose this path for continuous transmission of data, so it can avoid fracture and from the heart if you encounter in the transmission path traced back to the source node to link, the entire network at this time of the delay could be greatly reduced, so as to avoid excessive routing overhead.

4. Conclusions

In general, the establishment of the reactive route and the keeping way in AODV protocol can meet the requirements of wireless sensor networks, helping the data transmit effectively. However, we can not ignore the disadvantages: too much energy consumption and back to provenance for link break in the keeping process. This new kind of multipath route mechanism can get rid of the flaws to ensure the applying effect of AODV in WSNs.

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