

A SURVEY ON SECURE AND EFFICIENT MULTI-PATH ROUTING TECHNIQUES IN WIRELESS SENSOR NETWORK

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Abstract: In this paper the multi-path routing is to improve the efficient, load balancing and quality of service in WSN and also provide reliability and security. We provide a survey of proposed multipath routing protocol for WSNs. Its benefits and the elements of these schemes and their classifications based on their attributes have been also discussed. Which are classified into three categories, infrastructure, on-infrastructure, and coding on multiple paths and delivering sensing data. We study the design of protocols; analyze the tradeoff of each design, and different properties of protocols. In this paper summary are design main goals, challenges and evaluation for multi-path routing protocols. In addition the multipath routing protocols to improve the load balancing and quality of service in WSN and also provide reliable communication the comparison of these protocols which are of great help to understand the properties and limitations.

Keywords: sensor Network, Routing, Multipath Path discovery.

I. INTRODUCTION

A wireless sensor network (WSNs) consists of a large number of sensor nodes having limited battery life, computational capabilities, storage, and bandwidth. These low-cost sensor nodes can be deployed either randomly by dropping from an airplane or precisely using manual deployment. These sensor nodes sense a change in the environmental or a physical quantity and transmit this data to the base station, also referred to as a sink node. The sink node is usually a powerful machine like a Laptop or a Desktop. Routing in WSNs is very important and it is distinguished from other networks due to the following characteristics:

- An internet protocol applied in WSNs, limited available resources and an very large scale.
- An IP-based scheme is difficult to be applied in WSNs, because of limited available resources and an extremely large scale. Efficient use of resources is essential.
- The routing protocol, in WSNs, most traffic is routed from nodes to the base station.

There are mainly two types of routing techniques, single path routing and multiple path routing.

Single path routing is simple and scalable, but does not efficiently in WSNs. It is simple route between the source node and the destination node can be established in a specific period of time. It is scalable because, if the network changes from ten nodes to ten thousand nodes, the characteristics of WSNs, single path routing is not efficient for the following reasons.

- In single path routing, the source node to select the inter-mediate data routing nodes from the same part of the network over and over again. This shortens the lifetime of WSNs.

- In WSNs, failures are common because of insufficient power, limited storage space, unreliable wireless communication, or unpredictable environmental interference.
- In single path routing, the presence of a malicious node on the path can manipulate and corrupt the data without catching the attention of the sink node.

Multipath routing is an alternative routing technique, which selects multiple paths to deliver data from source to destination. The nature of multipath routing that uses redundant paths, multipath routing can largely address the reliability, security and load balancing issues of single path routing protocols. The basis of the protocol feature and its specification we classify existing multipath routing techniques into three categories: A) Infrastructure Based, B) Non-Infrastructure based, and C) Coding Based.

II. RELATED WORK

In this survey papers focus on different requirements from various applications, routing protocol design and different performance. For example surveys on routing protocols from real-time, security, dependability and fault-tolerance. Surveys such as [1], [6], [2] present comprehensive reviews on previous routing protocols from all perspectives. In [1] the authors focus on discussing design challenges and design principles of various routing protocols in WSN. In [6] The paper also discusses protocol design and exhibits that the ultimate goal of a routing protocol is to be energy-efficient on 3D WSNs. Another paper [2] addresses various routing protocols with network architecture and their design issues. Routing protocols have been classified into three categories including data-centric, hierarchical, and location-based. In [3] the authors discuss the fault-tolerant technique of routing protocols in WSNs. According to the paper,

multipath routing is the best approach for fault-tolerance. In another paper [4] the authors present the concept of routing dependability in various networks, which is defined as trust worthiness of the routing scheme and its performance. In [5] the authors present a survey on routing protocols and discuss the problem of end-to-end reliability. The paper discusses various transport protocols and includes a detailed comparison of their functionality. We presented a set of multipath routing protocols and classified them on the basis of their routing techniques.

III. MULTIPATH ROUTING PROTOCOLS IN WSNs

The multipath routing approach is to achieve data reliability, security and load balancing. Achieving all these goals in the resource constrained and often randomly deployed WSNs, is quite a challenge. Various techniques have been proposed in efficient multipath routing protocol design. There are also many heuristic multipath routing protocols proposed to establish multiple paths based on energy budget or the distance to the sink.

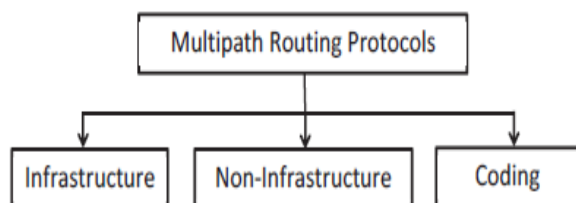


Figure 1. Classifications of multipath routing protocols.

In this paper, we classify the existing multipath routing protocols into three categories as shown in Figure 1. Infrastructure based multipath routing protocols try to discover and maintain multiple paths from source to destination before data transmission. In contrast, non-infrastructure based multi-path routing protocols do not try to establish and keep multiple paths. Finally, we classify all protocols using different types of coding or data fragmentation techniques, into the category of coding based routing protocols.

Infrastructure Based Multipath Routing Protocol: Each node stores a list of capable neighbors which can efficiently transfer the data. node's location, position in the structure and capability, multiple paths are discovered. An infrastructure provides reliable and fast data transmission. It also provides the protocol reducing failure recovery time by assigning the alternative route, which is also discovered in advance. To achieve reliability, security, and load balancing, protocols use different techniques. the basis of the technique used by the protocol to build multiple paths.

Energy-aware Multipath Routing Protocols : sensor nodes have very limited amounts of energy, and in order to prolong the network lifetime, energy-aware approaches avoid choosing sensors with low energy in data forwarding. it is a good heuristic in balanced efficient routing protocols. The main purpose of message broadcasting is to collect information of the neighboring nodes and to build the neighboring. The neighboring nodes including residual energy, hop distance, and signal strength. The node to decide the best next hop by using the attributes stored. This scheme leads to a multiple- path infrastructure, which is

created from the nodes that satisfy the specific requirements. Energy-aware protocols use reactive routing, meaning that the path is created only when it is required. This reduces much of the communication overhead. Path maintenance is another major concern for every multipath routing protocol.

Non-Infrastructure Based Multipath Routing Protocols :

To transmit the data are considered non-infrastructure multipath routing protocols. In non-infrastructure based routing protocol, the path is discovered as the data packet moves forward. non-infrastructure multipath routing, every intermediate data routing node makes a decision on the basis of its local knowledge instead of preset next hop information, in order to forward the packet. one of the major concerns of non-infrastructure multipath routing protocols is forwarding the data packet in the direction of the sink. Non-infrastructure multipath routing protocols main advantages. First, there is no path maintenance required because as the packet moves forwards the path is created by the intermediate nodes based on their local knowledge. Second, the randomized routing mechanism, used by the protocols to route the data, is energy-efficient and helps to achieve load balancing. Finally, the protocols using dynamic packet state (DPS) in which each data packet header contains some information about network conditions from the previous node helps the receiving node make better forward decision.

Coding Based Multipath Routing Protocols :

In infrastructure based protocols, path construction and maintenance are two major overheads. Data transmission, however, will be straight forward by following the established routes, although in order to achieve reliability the same data packet is transferred through all multiple paths. This is energy inefficient and not secure. the non-infrastructure based protocols have no path construction and maintenance overheads, but have problems with secure data transmission. Coding techniques can be used to address those two issues in multipath routing. First, some intermediate data routing nodes get into malicious activity, they will not be able to eavesdrop the network, the data packets travel in encoded form and are only decoded at the destination node. Second, it saves a lot of energy by not sending the same copy of data using multiple paths. There are different types of coding schemes such as erasure coding, network coding, and XOR- based coding, each of which has its own compression and decompression efficiency. The selection of the coding technique is based on the requirement of the application.

IV. CONCLUSION

In this paper, the proposed multipath routing protocols in WSNs. We classify multipath routing protocols mainly based on whether the proposed routing protocol creates multiple path infrastructure or not. the special importance of coding techniques in multipath routing, we discuss a set of coding technique based multipath routing protocols in detail. In addition, a group of multipath routing protocol design issues such as major design goals, challenges and evaluation metrics are presented in the paper. This paper presented a comprehensive analysis of multipath routing protocols in wireless sensor networks and specified the challenges related to designing multipath routing protocols in WSN and compared various properties of these routing protocols.

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