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Review of Multipath Routing Protocols in Wireless Multimedia Sensor Network –A Survey

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Abstract—Various applications like automated information gathering in military, industrial, environmental and surveillance applications requires improved QoS guarantee as well as high reliability in Wireless Multimedia Sensor Networks (WMSNs). In this paper, we have exhaustly reviewed various multi-path routing schemes and classified them accordingly to be suitable for multimedia-traffic. Benefits of using Multipath routing protocols are represented. In general detailed study has been made on multipath routing scheme with Qos requirement for transmission of multimedia data in Wireless multimedia sensor networks.

Index Terms— Disjointness, Energy Efficiency, Multimedia Data, Multipath Routing, QoS Routing, WSN, WMSN.

1 INTRODUCTION

THE dense deployment of small, low-powered, self-organising sensor nodes in WSN can sense and process the scalar data such as temperature, humidity, pressure etc. of the physical environment. In the recent years due to the advancement in the micro-electronics and wireless communications, in addition to availability of cheap CMOS cameras and micro phones, have allowed the emergence of a new promising Wireless Multimedia Sensor Networks (WMSNs). Most of the researchers envisioned that performance of the existing applications of WSN drastically can be enhanced with the aid of multimedia sensors which can gather audio, video, image information etc. along with scalar data. Multimedia applications require that additional challenges be addressed for energy-efficient multimedia processing; these challenges include optimal routing and path selection, audio/video rate adaptation to meet the dynamic network topology and application specific QoS guarantees, such as end-to-end delay, packet delivery ratio, and data rates. The authors have discussed the unique characteristics of WSNs and WMSNs in previous publications [1],[2],[3]. Many of the WMSN multimedia applications necessitate that efficient mechanisms be developed for the transportation of the multimedia information meeting a certain level of QoS demand. Because multimedia data are large in size, they consume more energy, which in turn drains batteries very quickly, making the node unavailable, even for low energy sensing tasks. In single-path routing, each source sensor sends its data to the sink via the shortest path. With single path routing, path breakage due to node failure requires initiation of a new route discovery process, which increases energy consumption. Node failure causes packets to be dropped and may cause a delay in delivering the data to the sink in time; thus the real-time requirements of the multimedia applications are not met. It is desirable to find alternative methods of reducing the effect of node failure on performance. Multi-path routing is desirable because an increase in the number of possible routes increases the robustness and throughput of the transmissions. Since bandwidth may be limited in a wireless network, routing along a single path may not provide enough bandwidth for a connection. However, if multiple paths are used simultaneously to route data, the aggregate bandwidth of the paths can satisfy the bandwidth requirement of the application. Also, since there is more bandwidth available, a smaller end-to-end delay can be achieved. Multipath routing is mainly used either for load balancing or for reliability. Load balancing can be achieved by balancing energy utilization across the nodes in the network, which results in enhanced network lifetime.

The rest of the paper is organized as follows. In section 2, related work is reviewed. Section 3 describes different classes of routing protocols for sensor networks and a number of various other multipath routing protocols proposed in the literature. Conclusions are provided in section 4.

2 RLEATED WORK

The important issue to be considered from the communications point of view is routing. A good survey of major routing techniques in WSN is provided in [4]. Routing in WMSN's is a demanding task. This demand has led to a number of routing protocols which efficiently utilize the limited resources available at the sensor nodes in addition to the features of multimedia data. This section describes the multipath routing protocols that exist in the literature on WSNs and discussed the benefits of using Multipath schemes in routing. The numerous challenges and issues that the developer must face while designing routing protocols for the transmission of multimedia data due to its resource-intensive nature compared to the traditional data are discussed in [1],[2],[3],[5].

There are many goals of Multipath routing protocols to achieve such as Reliability, Load Balancing, High Aggregate Bandwidth, Minimum End to End Delay, Minimum Energy consumption, High throughput. In the literature, many multipath routing protocols that consider the nature of the multimedia data along with the characteristics of the underlying WSN are proposed. There are many performance criteria to evaluate the routing protocols like Control overhead, Packet delivery ratio, Routing load, Bandwidth cost for data, Average end-to-end delay, Jitter, Activity distribution, Load balancing, Energy balancing and Average energy consumption. In [6], authors have presented an overview of some multipath-based routing protocols and compare them based on various factor like, energy efficiency, low delay, high data accuracy and fault tolerance.

2.1 Benefits of Multipath Routing

Multi-path routing consists of giving a source node the possibility to use any of several paths to a particular destination at any given time. It was shown in [7] that in wireless networks, route coupling - a phenomenon of interference between two (or more) paths caused by radio interference or contention between paths can have serious impacts on the performance of multipath routing protocols, even if the paths are topologically disjoint. In a wired network route coupling is gauged by path disjoint ness, but in a radio network routes are also considered heavily coupled if transmission on one route directly impedes the qualities of that of the other. Route coupling can be alleviated by making changes at the physical/link layers, such as using multiple channels [7], or directional antennae [8]. Multipath routing reduce the over loading of any one node, which result in preventing that node running out of battery. By taking advantage of the connectivity redundancy in the WSN, the source node would have a database of all available paths to a particular destination (the sink) at all times. In [9], authors outlied the various benefits that can be gained by the use of Multipath routing and the components of Multipath routing is also discussed. There exists many benifits of the multipath routing in addition to Load balancing, reliability, fault tolerance, Application specific QoS, Alleviating the network congestion, Smoothing out the traffic, Reduce the frequency of route discoveries, Enhancing the privacy of the information being sent, Extending the lifetime of the system in WSNs by distributing more homogeneously the power consumption among its nodes.

- **Bandwidth aggregation**

By splitting data to the same destination into multiple streams, each routed through a different path, the effective bandwidth can be aggregated. This strategy is particularly beneficial when a node has multiple low bandwidth links but requires a bandwidth greater than an individual link can provide.

- **Reduced end to end delay**

For wireless networks employing single path on-demand routing protocols, a route failure means that a new path discovery process needs to be initiated to find a new route. This results in a route discovery delay. The delay is minimized in multipath routing because backup routes are identified during route discovery. End-to-end delay may also be reduced as a direct result of larger bandwidth available with the use of Multipath routing.

Authors in [10], proposed a protocol for multipath video streaming over WSNs. Multiple disjoint paths can achieve high throughput and desirable delay and meet the QoS requirement of multimedia streaming.

- **Load balancing**

The main goal with load balancing is to make more use of available network resources in order to minimize the risk of traffic congestion. When a link becomes over-utilised and causes congestion, multipath routing protocols can choose to divert traffic through alternate paths to ease the burden of the congested link. Load balancing can be achieved by spreading the traffic along multiple routes. This can alleviate congestion and bottlenecks. Hopefully this would lead to less delay and packet loss. It could however lead to additional propagation delay if the alternative routes are badly chosen. Some applications are very sensitive to delays (e.g. VoIP). Others are more sensitive to packet loss. The usefulness of multi-path routing to achieve lifetime improvements by load balancing and exploiting cross-layer information in WSNs is investigated in [11].

- **Alleviating network congestion**

. Transmission collision occurred at nodes that receive packets from multiple nodes at the same time greatly reduces the network performance. Therefore, the services provided by the sensor network are also greatly impacted. In [12], authors proposed a novel mechanism to find multiple-paths between one sink and multiple-sources with the consideration of reducing collision occurred at nodes that are receiving and forwarding packets on behalf of the source nodes. Previous multiple path routing methods use flooding for route discovery and transmit data with maximum power regardless of need, which results in waste of energy. Moreover, often a serious problem of collisions among multiple paths arises. Authors in [13] proposed an energy efficient and collision aware (EECA) node-disjoint multipath routing algorithm for wireless sensor networks. With the aid of node position information, the EECA algorithm attempts to find two collision-free routes using constrained and power adjusted flooding and then transmits the data with minimum power needed through power control component of the protocol.

- **Reliability**

Reliability of data transmission is a key question in data-centric Wireless Sensor Networks (WSNs). In WSN data produced by one or more sources usually has to be routed through several intermediate nodes to reach the destination. Problems arise when intermediate nodes fail to forward the incoming messages. Reliable monitoring of the environment is important in a variety of commercial and military applications, for example, in security systems used to detect intrusions and to monitor machines for fault occurrence and diagnosis; acoustic, seismic and video sensors can be used in these applications. Multipath routing is one way of improving the reliability of the transmitted information. Reliable data delivery is achieved by sending multiple copies of the same data on multiple paths, which increases the accuracy of tracking. In [14], authors analyzed a new mechanism that enables the tradeoff between the amount of traffic and the reliability. The data packet is split in k subpackets (k = number of disjoined paths from source to destination). If only Ek subpackets ($Ek < k$) are necessary to rebuild the original data packet (condition obtained by adding redundancy to each subpacket), then the trade-off between traffic and reliability can be controlled. A multi-path based transmission method is presented in [15] to solve reliability problem for hierarchical WSNs. The method can find all paths for any arbitrary given node to base station, and select the best way based on energy-awareness.

In [16], authors proposed a Robust Energy Efficient Multipath routing protocol (REER) which uses the residual energy, available buffer size, and Signal-to- Noise Ratio (SNR) to predict the best next hop through the paths construction phase. REER examines two methods of traffic allocation: REER uses the alternative path if the path cost of the path choosen from the discovered paths falls below a threshold in the first method. The second method splits the transmitted message into number of segments of equal size and then transmits it across multiple paths simultaneously to increase the probability that an essential portion of the packet is received at the destination without incurring excessive delay.

Authors in [17], proposed a protocol called ReInForM to delivere the data at desired levels of reliability at proportional cost, in spite of the presence of significant channel errors. It uses the concept of dynamic packet state in context of sensor networks to control the number of paths required for the desired reliability using only local knowledge of channel error rates and does not require any prior computation or maintenance of these multiple paths.

- **Supporting Application specific Quality of Service (QoS)**

Most of the proposed routing protocols for WSN are concentrating on efficiently using extremely constrained resources, especially the energy. However, one important factor of the routing protocols, QoS routing has not been paid enough attention from researchers. In addition to minimizing energy consumption, it is also important to consider QoS requirements in terms of delay, reliability, and fault tolerance in routing in WSNs. The authors in [18] addresses the issue of QoS Routing to improve energy consumption in WSNs by formulating a path-based energy minimization problem subject to QoS routing constraints expressed in terms of reliability, delay and geo-spatial energy consumption. Authors in [19] have presented a novel QoS-aware routing protocol to support high data rate for WMSNs. Being multi-channel multi-path, the routing decision is made according to the dynamic adjustment of the required bandwidth and path-length-based proportional delay differentiation for real-time data. In [20], author proposed a multi-path scheme which utilizes the virtual grid, to meet the real-time requirements. In order to select one of multi-paths depending on the service differentiation, the proposed scheme uses several information such as the size and transfer period of sensed data. In addition to an existing path, the proposed algorithm dynamically selects an alternative path according to multi-path environments. Moreover, it assigns the shortest path to the sensed data with most strict time restriction. Authors in [21], proposed a Multiconstrained QoS multipath (MCMP) routing inWSN. Based on this model, an approximation of local multipath routing algorithm is explored to provide soft-QoS under multiple constraints, such as delay and reliability. This MCMP routing algorithm trades precise link information for sustainable computation, memory and overhead for resource limited sensor nodes.

- **Improve the network security**

Routing security in WSN is considered in [22]. Many sensor network routing protocols have been proposed, but none of them have been designed with security as a goal. Security goals for routing in sensor networks proposed in [22], show how attacks against ad-hoc and peer-to-peer networks can be adapted into powerful attacks against sensor networks, introduce two classes of novel attacks against sensor networks–– sinkholes and HELLO floods, and analyze the security of all the major sensor network routing protocols.

- **Energy considerations**

An Energy Efficient Multi-path Routing Protocol is proposed for WMSN's in [23]. It takes a view that, always using the minimum energy path deprives the nodes energy quickly and the time taken to determine an alternate path increases. It uses multiple paths between source and the sink which is intended to provide a reliable transmission environment with low energy consumption, by efficiently utilizing the energy availability of the nodes to identify multiple routes to the destination. For the purpose of real-time transmission of multimedia data, authors of [24] proposed a new QoS protocol called Real time Energy Aware (REAR) applied to WMSNs. In this protocol metadata is used to establish multi-path routing for reducing the energy consumption. In [25], authors proposed an energy-efficient multipath routing protocol for WSNs distributes the traffic over the multiple paths discovered based on their cost, which depends on the energy levels and the hop distances of nodes along each path.

- **Improving the fault tolerance**

The WSNs are often subject to high failure rates due to environmental noise and obstacles, and nodes may die due to battery depletion, environmental changes or malicious destruction. In such an environment, reliable and energy-efficient data delivery is crucial because sensor nodes are often operated with limited battery power on error-prone wireless channels. In traditional WSNs, faults would either continue to occur at high frequencies or stop occurring after a certain moment in time [26]. The high-frequency fault occurrences have a more serious impact on WMSNs than on traditional WSNs because of the huge volume of the video or audio streams. The problem of path breaks due to node failure leads to the requirement of additional routing overhead to find alternative paths, which reduces the energy of the nodes and affects the network lifetime. Routing protocols must be designed to achieve fault tolerance in the presence of individual node failure while keeping energy consumption at a minimum. Earlier works using single path routing used flooding to route around failed nodes. Flooding suffers from deficiencies such as implosion, overlap and resource blindness. Such flooding can adversely impact the lifetime of the energy-constrained sensor network. Multipath routing protocols can provide fault tolerance by having redundant information routed to the destination via alternative paths. This reduces the probability that communication is disrupted in case of link failure. More so-

phisticated algorithms employ source coding [27] to reduce the traffic overhead caused by too much redundancy, while maintaining the same degree of reliability. This increase in route resiliency is largely depended on metrics such as the diversity, or *disjointness*, of the available paths. In WSNs, reliability is a design goal of a primary concern. To build a comprehensive reliable system, it is essential to consider node failures and intruder attacks as unavoidable phenomena. In [28], a new intrusion-fault tolerant routing scheme is presented based on a distributed and in-network verification scheme offering a high level of reliability through a secure multi-path routing construction, which does not require any referring to the base station. Furthermore, it employs a new multi-path selection scheme seeking to enhance the tolerance of the network and conserve the energy of sensors.

Some sensitive applications such as volcanic monitoring, fire detection data should be transmitted within a specified delay to the base station. Multipath-GT (Multipath – Generalized Topology) model uses an on-demand approach to estimate a delay based on processing time, packet loss rate between two neighbouring nodes. In existing work, if a node or link failure occurs multipath routing didn't spread traffic over alternate paths. Authors in [29] take a view that, when certain nodes and links become over-utilized and cause congestion, proposed work can spread traffic over alternate paths to balance the load over those paths and increase the degree of fault tolerance. The simulation results show that reduces the probability of communication disruption and data loss during link failures.

3 MULTIPATH ROUTING TECHNIQUES

This section provides a short overview of the different classes of Multipath routing protocols suitable for sensor networks. Paragraph 3.1 gives an introduction to the different criteria by which protocols can be classified. while paragraph 3.2 describes the proposals of multipath routing protocols presented in the literature.

3.1 Classification of Multipath Routing Techniques

There are three main phases of multipath routing: path discovery, traffic distribution, and path maintenance. The path discovery phase determines the available paths for a source-destination pair. During the traffic distribution phase, the number of paths for distributing traffic is selected. Path maintenance is responsible for regenerating paths after the initial path discovery. It can be initiated either after each path failure or when all the paths have failed. By looking into the related work in Multipath Routing in the past, Multipath protocols can be classified in two ways, as shown in Fig. 1, based on the way the routing paths are established during the path discovery phase and on the way the routing paths are selected to distribute the traffic. Based on the application needs, the protocol may use characteristics of both methods of classification.

3.1.1 Path discovery based Multipath Routing

During the path discovery process, disjointness can be used as a criterion by a protocol to find possible paths; this parameter describes the independence of the paths in terms of shared resources. The set of paths between a source node and a destination node can be classified based on the degree of path disjointness, namely non-disjoint paths and disjoint paths.

3.1.1.1 Non-Disjoint Paths

Non-disjoint paths, also referred to as joint multi-paths, can have links and nodes in common with any loop-free paths.

3.1.1.2 Disjoint Paths

The Disjoint Multipath process attempts to find disjoint paths based on the degree of independence of each path. These paths can be classified as follows:

- **Link-disjoint Multipath**

Link-disjoint paths refer to set of paths that have no common links but may share some common intermediate nodes. In [30], authors presented a multipath routing scheme to distribute the traffic over the multiple link-disjoint paths based on the path deputies principle "one neighbor one deputy service, different neighbor different deputy service".

- **Node-Disjoint Multipath**

This refers to the set of paths in which each path does not share any nodes other than the source and the destination nodes. Thus they are unaffected by failure on the other path. Most existing routing protocols are not very practical for transmitting multimedia contents in resource constrained sensor networks. In [31], an optimized nod-disjoint multi-path routing scheme is proposed resulting in throughput enhancement and load balancing for transmitting multimedia content. In [32], authors proposed TPGF is the first multi-path routing protocol in the WMSNs field. It focuses on exploring the maximum number of optimal node-disjoint routing paths in network layer in terms of minimizing the path length and the end to end transmission delay as well as taking the limited energy of WSNs into consideration.

- **Totally disjoint Multipath**

While concurrent data transmissions take place, the set of distinct paths that are zero-edge connected, and hence do not interfere, are referred to as totally disjoint paths. In [33], a totally disjoint multipath routing in multi-hop wireless networks that provides an evaluation of the throughput in a multipath routing strategy considering the impact of interference is presented. Here the author's focuses on networks with fixed and non-energy constrained wireless backbone. The authors adopt an incremental approach to address the problem by first considering the interference between a single source-destination pair and next between multiple sources and destinations.

- **Maximally Disjoint Multipath**

A set of node-disjoint paths that maximises a disjoint charac-

teristic among possible paths, while keeping common nodes at a minimum, is referred to as a set of maximally disjoint paths.

Fully disjoint paths are not always available in WMSNs. If so, an alternative solution is to use partially disjoint paths, especially the maximally link-disjoint paths. A pair of paths from a source to a destination is defined to be maximally link-disjoint if the number of links shared by both paths is minimum. Considering fully disjoint paths have zero joint, we conclude that multipath routing prefers the paths with minimum joints in general.

- **Radio Disjoint Multipath**

The set of paths with minimum radio interference, or the multiple non-interfering paths that are used to reduce the effect of interference between nodes as far as possible, are referred to as Radio Disjoint Multipaths (RDM).

The author of [34] presented a Maximally Radio-Disjoint Multipath Routing (MR2) addressed the problem of interfering paths in the context of WMSNs and consider both intra-session as well as inter session interferences. To provide necessary bandwidth to multimedia applications an incremental approach where for a given session, only one path is built at once is adopted. Additional paths are built when required, typically in case of congestion or bandwidth shortage. Radio disjoint multi-path routing in MANET is discussed in [35] and is an approach to choosing multiple paths to be used simultaneously, reducing the effect of interference between nodes as far as possible. To measure the interference level of a node, the authors considered a mechanism to measure the load of a node in terms of a given parameter to measure the packets transmitted or received by the node itself and to measure all the packets heard from the other nodes in the vicinity. The RDMs can be classified as follows:

- Full Radio Disjoint Multiple Paths (FRDM)

Mutual interference between all the intermediate nodes of each simultaneously active path is considered as zero. FRDM routes must be node disjoint.

- Partial Radio Multiple Disjoint Paths (PRDM)

In this case, some of the intermediate nodes of each selected path are interfering while the rest are not. PRDM routes can be created either with link disjoint or node disjoint routes.

- Non Radio Disjoint Multiple Paths (NRDM)

All the intermediate nodes of each selected path are interfering with each other. Even node disjoint routes can be NRDM depending on the topology of the nodes.

- **Partially Disjoint paths - Braided Multipath**

A set of node-disjoint paths with relaxation of node-disjointness is referred to as a set of partially disjoint or braided paths. For each node on the primary path, a best alternative path from a source to a sink that does not include that node is computed. These alternate paths could potentially have much comparable latency to that of the primary path and therefore expend more or less same amount of energy as that on the primary path.

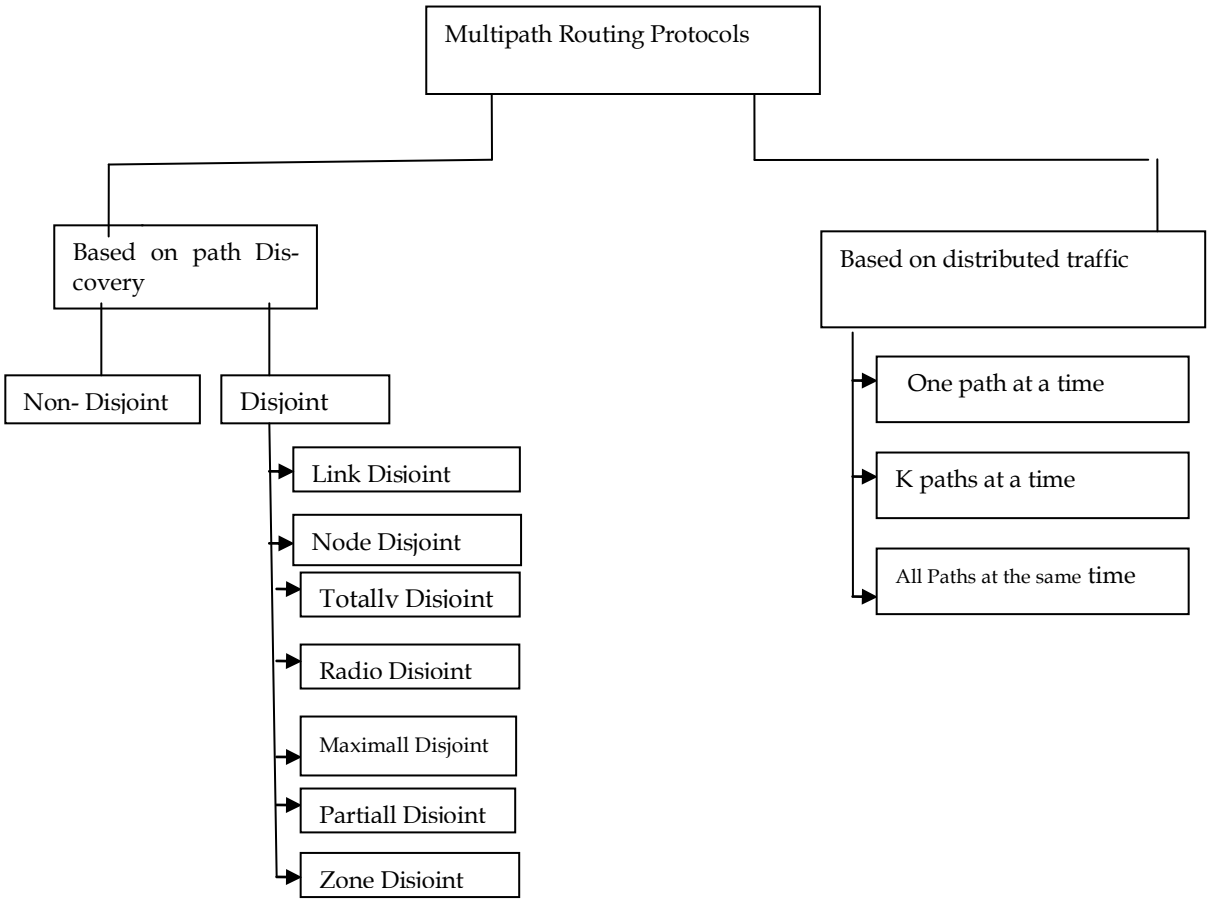

Fig. 1 Classification of Multipath Routing Protocols in Wir less Multimedia Sensor Network

In [36] authors have investigated multipath routing algorithm and compare them with single path based on the expectation of lifetime of each of the disjoint multipath and braided multipath mechanism. In [37], the authors proposed the Classical node-disjoint multipath and a novel braided multipath that consisted of partially disjoint alternative paths to demonstrate the energy/resilience trade-offs of these mechanisms for both independent and geographically correlated failures. The multipath routing techniques designed for ad hoc network do not apply to the sensor network due to the lack of global ID in sensor networks. In [38], the authors prpose a novel approach called 'Label-based Multipath Routing' (LMR) that can efficiently find a disjoint or segmented backup path to provide protection to the working path when com-pared to the disjoint or braided multipath methods.

- **Zone–Disjoint Multipath**

This refers to the set of paths in which data communication on one path will not interfere with the data communication on the other path.

High-rate streaming in WSN is required for future applications to provide high-quality information of battlefield hot spots. Although recent advances have enabled large-scale WSN to be deployed supported by high-bandwidth backbone network for high-rate streaming, the WSN remains the bottleneck due to the low-rate radios used and the effects of wireless interferences. Authors in [39] first proposed a technique to evaluate the quality of a path set for multipath load balancing, taking into consideration the effects of wireless interferences and that nodes may interfere beyond communication ranges. Second an interference- minimized multipath routing (I2MR) protocol that increases throughput by discovering zone-disjoint paths for load balancing, requiring minimal localization support. Third, propose a congestion control scheme that further increases throughput by loading the paths for load balancing at the highest possible rate supportable. Finally, validate the path-set evaluation technique and also evaluate the I2MR protocol and congestion control scheme by comparing with AODV protocol and node-disjoint multipath routing (NDMR) protocol.

3.1.2 Distribution of traffic-based Multipath Routing

There are various strategies for allocating traffic over available paths. A path selection algorithm is used to select a subset of available paths according to certain qualities of the paths and based on the purpose of the multiple paths. The first one is a back-up path is set up simultaneously as the main path for emergency. When the main path is down, the source node uses the back-up path. Secondly, multiples paths can be used to handle congestion and keep load balancing. When a path has heavy traffic, other paths will be utilized to reduce the congestion. Finally, multiple paths can be used to increase the end-to-end performance (e.g., high throughput and low delay) by transporting data through multiple paths.

- **One path at a time**

This refers to a set of paths in which the traffic is forwarded using only one path that has the best metric; the other discovered paths are kept as backups.

- **Simultaneous use of K- paths**

This refers to a set of paths in which the forwarding of traffic would take place over K distinct paths simultaneously. In [40], author's focuses on delivering the packets at desired reliability based on the information sensed using a multipath routing technique. The information is delivered reliably using the less number of transmissions of data packet. Only limited numbers of paths are used between the source and the destination based on criticality of the information to be delivered instead of using all possible paths. Authors in [41], proposes that Multipath Data Transfer protocol provides simultaneous multiple paths for communication between any two nodes. This algorithm distributes the work among the nodes uniformly prolonging the life of WMSN.

- **All paths at the same time**

This refers to a set of paths in which the traffic is forwarded on all of the available multiple paths simultaneously to further reduce delivery time and hence increasing the delivery ratio.

3.2 Proposals of Multipath Routing Techniques

The different Multipath roting protocols proposed in the literature are discussed in this section. The protocols discussed provide multiple paths from sources to destinations in some way. Some protocols simply provide partial backups of routes, while others provide multiple complete routes from source to destination. Based on application demand one or more of the type of multipath mentioned in the previous section is selected and along with some specifications of the application are incorporated in the routing scheme to increase the performance, such as service differentiation can be provided by assigning priority to the packets to achieve required level of QOS. Even the paths can be given priority. Conditions of the resources such as energy, bandwidth etc. along the paths can be considered to make routing scheme adaptive to increase the performance.

Sequential Assignment Routing (SAR) proposed in [42] is a

multi-path routing protocol that makes routing decisions based on three factors: energy resources, QoS on each path, and packet's priority level. Multiple paths are created by building a tree rooted at the source to the destination. During construction of paths those nodes which have low QoS and low residual energy are avoided. Upon the construction of the tree, most of the nodes will belong to multiple paths. To transmit data to sink, SAR computes a weighted QoS metric as a product of the additive QoS metric and a weighted coefficient associated with the priority level of the packet to select a path. Employing multiple paths increases fault tolerance, but SAR protocol suffers from the overhead of maintaining routing tables and QoS metrics at each sensor node.

In [43] author has proposed on technical issues for supporting QoS constrained traffic in wireless sensor networks and it highlights architectural and operational challenges of handling of QoS traffic in sensor networks. Transmission of imaging data and video streams requires both energy and QoS aware routing in order to ensure efficient usage of the sensors and effective access to the gathered measurements. Delivering such time constrained data requires certain bandwidth with minimum possible delay and thus a service differentiation mechanism will be needed in order to guarantee timeliness in handling traffic in WMSN. It analyzes the challenges of supporting QoS in traffic at the network and link layers. The transmission of imaging and video data requires careful handling in order to ensure that end-to-end delay is within acceptable range and the variation in such delay is acceptable. Such performance metrics are usually referred to as QoS of the communication network. It uses the different traffic models for handling the communication between source and sink in order to forward the packets on different paths.

In [44] author proposes the packet and path priority scheduling in multipath video transmission over WMSN. Here video stream data is partitioned to image and audio stream and two kinds of priority are given to them for using of limited bandwidth and energy in WMSN according to application requirements. Video packets are classified according to their types and more important packets are transmitted through paths with better conditions. Path conditions are evaluated by a score mechanism using variant parameters such as free buffer size, energy, hop count and packet loss. In [45], authors proposed Multipriority Multi-Path Selection (MPMPS) algorithm which should be executed after the TPGF explored all the node disjoint routing paths. In MPMPS, the more important multimedia stream always chooses the routing path with the higher priority to transmit. MPMPS algorithm has two phases: First it Searches the maximum number of paths for the stream with the higher priority and then Searches the maximum number of paths for the stream with the lower priority.

4 CONCLUSION

In this paer, we present the concept of Multipath routing with its applications in WSN and WMSN. Multipath routing is a promising technique for achieving reliability, load balancing, high aggregate bandwidth, minimum end to end delay, minimum energy consumption and high throughput. Multipath routing protocols ensure that the Quality of Service (QoS) demand of the applications is met and that energy efficiency is addressed. Multipath routing can reduce the need for route updates, balance the traffic load and increase the data transfer rate in a WSN, improving the utilization of the limited energy of sensor nodes. We have listed the benefits of using Multipath schemes in routing and described the various classes of Multipath routing. We also provided various other proposals of Multipath routing discussed in literature. It is observed that there is an urgent need to develop routing protocols that are more energy efficient, are more reliable and have better control regarding the QoS requirements of multimedia data. In this paper we have covered all the aspect of Multipath Routing and Qos which is essential for requirement for multimedia data transfer over wireless Sensor Network.

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