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Enhancing QOS on WSN using Secure Routing Algorithms

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Abstract— For Real-time video broadcast where multiple users are interested in the same content, mobile-to-mobile cooperation can be utilized to improve delivery efficiency and reduce network utilization. Under such cooperation, however, real-time video transmission requires end-to-end delay bounds. Due to the inherently stochastic nature of wireless fading channels, deterministic delay bounds are prohibitively difficult to guarantee. For a scalable video structure, an alternative is to provide statistical guarantees using the concept of effective capacity/bandwidth by deriving quality of service exponents for each video layer. Using this concept, we formulate the resource allocation problem for general multi hop multicast network flows and derive the optimal solution that minimizes the total energy consumption while guaranteeing a statistical end-to-end delay bound on each network path. A method is described to compute the optimal resource allocation at each node in a distributed fashion. Furthermore, we propose low complexity approximation algorithms for energy-efficient flow selection from the set of directed acyclic graphs forming the candidate network flows. The flow selection and resource allocation process is adapted for each video frame according to the channel conditions on the network links. Considering different network topologies, results demonstrate that the proposed resource allocation and flow selection algorithms provide notable performance gains with small optimality gaps at a low computational cost.

Now, whether the WSNs are starting to become a reality in this world, but there are some limitations such as change in topology randomly, restrictions in power, limited computational resources like power, error-prone medium, energy efficiency. Now-a-days, most of researchers are using their skills mostly on designing issue of energy awareness routing approaches. Thus, energy consumption is an important limitation of WSN which demands researcher's skills to get a way in reducing the energy consumptions by sensor nodes used in WSN. In this paper, survey is done on different routing protocols based on clustering used for wireless sensor networks along with comparison and advantages and disadvantages of them. The main focus in this survey paper is on clustering routing approaches.

Keywords-WSM, Multipath routing.

I. INTRODUCTION

Today's in the market of rapid growth of computers the processing power are increased unexpectedly but the price and size of computers have greatly reduced which encourages the use of computers very much. The latest technologies have made vast advancements in computers era and also enhance the use of computers in our daily activities. In recent years, from the economic point of view, the single-purpose desktop computers having sensors embedded in them are highly used due to cheapness in prices and reduction in size of computers. Wireless Sensor Network is a recently increasing in demand by all people involving in many applications because of their substantial applicability to improve our lives. They aid us by extending our ability to accurately monitor, study, and control objects and environments of various scales and conditions such as human bodies, geological surveys, habitats, and security surveillance. Large no. of sensor nodes in a sensor field are used to transmit information about events to satellite associated through Sink node.

A wireless sensor network (WSNs) consists of a large number of light-weight 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 This emerging technology has been adopted by many elds as a promising solution to numerous challenges. For example WSNs is used in remote sensing, real-time tra-c monitoring, weather monitoring, military surveillance, health care , civil structure monitoring , forest re detection , re rescue and many other areas . In large scale WSN, the nodes are located far from the sink and therefore use the intermediate nodes to route the data packet towards the sink. Routing in WSNs is very important and it is distinguished from other networks due to the following characteristics [1, 2]:

An IP-based scheme is difficult to be applied in WSNs, because of limited available resources and an extremely large scale. Unlike traditional routing protocol, in WSNs, most tra-c is routed from nodes to the base station. In WSNs, the nodes are resource constrained in terms of energy, storage, and computational capacity. Efficient use of resources is essential. 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 satisfy the requirements of resource constrained WSNs. It is simple because the route between the source node and the destination node can be established in a specific period of time.

It is scalable because, even if the network changes from ten nodes to ten thousand nodes, the complexity and the approach to discover the path remains the same. While considering the characteristics of a WSNs, single path routing is not efficient for the following reasons. In single path routing, it is easy for the source node to select the intermediate data routing nodes from the same part of the network over and over again. This may cause depletion of power of those sensor nodes and network partition, which shortens the lifetime of WSNs. In WSNs, failures are common because of insufficient power, limited storage space, unreliable wireless communication, or unpredictable environmental interference. If any failure occurs, most single path routing protocols could not successfully deliver sensed data to the sink due to a lack of fault tolerance mechanisms.

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. Because of 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. Thus, multipath routing plays an important role in WSNs and many multipath routing protocols have been proposed in the literary of WSNs research. In this paper, we take an initial step to summarize all multipath routing techniques proposed in the WSN research literary. On the basis of the protocol feature and its speciation we classify existing multipath routing techniques.

There are three categories:

A) Infrastructure Based.

B) Non-Infrastructure based.

C) Coding Based.

The major concern of the protocols within category A is to construct and maintain specific multipath infrastructure by considering location and resource capabilities. Protocols which do not build any specific infrastructure and decide the next hop on the basis of its local knowledge are classified into category B. The category C protocols use variant kinds of coding schemes to fragment the data packet at the source node and then send the chunks through discovered multiple paths.

Besides this, because of the importance of routing protocols, there are also several survey papers discussing routing protocols in WSNs, but to the best of our knowledge, there is no such dedicated survey for multipath routing protocols. Furthermore, the scope of the survey presented in this paper is different from others. Within the exception of a summary of the design of previous multipath routing protocols, we provide an extensive analysis of the challenges and metrics in designing multipath routing protocols. Writing a comprehensive survey of the multipath routing techniques, we hope that this paper will serve as a good reference to those who are interested in multipath routing protocols. Furthermore, we hope this paper will provide merit to and trigger the design of more sophisticated multipath routing protocols, not only for WSN, but also for any critical systems built based on unreliable components, including Cyber-Physical Systems and Smart Grids.

Limitation of WSN:

Whether the WSNs are starting to become a reality in this world, but there are some limitations such as change in topology randomly, restrictions in power, limited computational resources like power, error-prone medium, energy efficiency.

II. LITERATURE REVIEW

The main purpose of 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, for example, network coding is used, where data at the source node is fragmented and transferred into chunks to different discovered paths, and controlled flooding is used to and proficient neighbours. There are also many heuristic multipath routing protocols proposed to establish multiple paths based on energy budget or the distance to the sink.

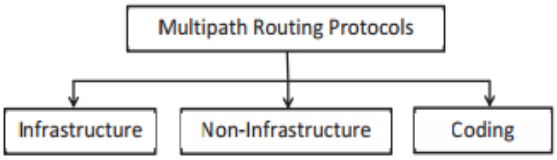

Fig – multipath routing protocols

Infrastructure Based Multipath Routing Protocol

The most important features of the infrastructure based multipath routing protocol is the construction and maintenance of multiple paths from source to destination. Any specific topology structure can help to build an efficient route from source to destination. For example, in a spanning tree, in which the WSN is considered to be organized into a tree and the sink node acts as a root of that tree, multiple paths are discovered by traversing the tree. To design an infrastructure not based on a specific topology structure, protocols use message broadcasting which helps them to collect information about their neighbours. Each node stores a list of capable neighbours which can efficiently transfer the data. Then, on the basis of heuristic information such as node's location, position in the structure and capability, multiple paths are discovered. These discovered paths are usually node-disjoint paths, which help to avoid data collision and interference.

An infrastructure provides reliable and fast data transmission because every intermediate data routing node has its next hop set up in advance. It also provides the protocol reducing failure recovery time by assigning the alternative route, which is also discovered in advance. Building an infrastructure is not enough to create an optimal multipath routing protocol. To achieve reliability, security, and load balancing, protocols use different techniques. Therefore, on the basis of the technique used by the protocol to build multiple paths, we further divide this category into three sub-categories: energy-aware, hierarchy based and ant-based.

Energy-aware Multipath Routing Protocols

Energy-aware multipath routing protocols are mostly heuristic protocols that pick up the next hop primarily based on the remaining energy of neighbouring nodes. Because 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. This presents network partition, because of early energy depletion of a part of sensors. Therefore, it is a good heuristic in balanced efficient routing protocols. Moreover, these protocols aim to balance the communication load based on the remaining energy of sensor nodes to balance energy consumption and provide data reliability using multiple paths. The protocols in this category construct the routes by broadcasting messages to whole network.

The main purpose of message broadcasting is to collect information of the neighbouring nodes and to build the neighbouring table. Each node contains a neighbouring table which stores the significant information about the neighbouring nodes including residual energy, hop distance, and signal strength. The neighbouring table helps the node to decide the best next hop by using the attributes stored in the table. 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. In order to keep track of path performance or path failure, the destination node monitors the inter-arrival delay for each data packet. If the delay is above a predetermined threshold, the sink will assume that the path is broken. In the following we present several representing protocols in this category, followed by a list of open problems.

By using the link quantity as a performance metric the authors in propose a multipath routing protocol, QoS and energy-aware multipath routing (QEMPR) for real-time application in WSNs. Each node in the network is assigned with a unique ID and also has a capability of calculating the packet receiving and packet sending probability using the link quality information. The multiple paths are discovered by message broadcasting and each node maintains a neighboring table which stores the information about the neighboring node such as remaining energy and transmission range. After constructing the paths, the packet will be transmitted based on the packet sequence number and number of hops it is away from the sink. This means the source will rst transmit the packet with the lowest sequence number through the path with the lowest hop number. Then the packet sequence number and the hops associated with the path go higher and higher. In this way the sink will receive the packet consecutively. This approach helps to distribute the network tra-c throughout the multiple paths, thus increasing network lifetime.

The authors propose EEAMR which focuses on distributing the tra-c based on the node's residual energy and received signal strength. For consistent resource utilization, more load is assigned to under-utilized paths and less load is assigned to over-utilized path. In order to save more energy, nodes which are not participating in the data transmission go into sleep mode.

In another paper authors propose a multipath routing protocol named Reliable and Energy E-cient multipath routing protocol (REEM) which constructs multiple paths from source to destination, considering node reliability and energy level. The path is constructed by a base station through message broadcasting and each receiving node will store the neighbouring information in a table. Also, the path reliability is evaluated by the base station through a weighted and oriented graph, based on the neighbour information. It is more challenging to be energy-efficient in large scale WSNs. Therefore the authors in propose a novel protocol named Multipath Routing in large scale sensor networks with Multiple sink nodes (MRMS) to save energy. The main idea is to deploy multiple sink nodes and uses path cost metric to select the multiple paths. The path cost metric is denied based on the distance between two neighbour, hop count and available energy at the node.

Hierarchy Based Multipath Routing Protocols

Hierarchy based multipath routing protocols focus on building the infrastructure in which nodes build a hierarchical relationship in order to discover efficient multiple paths. Hierarchical infrastructure has many advantages in WSNs. Firstly, it is appropriate for a large scale network because the communication overhead can be significantly reduced due to the hierarchy. Secondly, it prolongs the network lifetime by assigning the heavy workloads, such as selecting nodes, sending and receiving data, to the nodes with more residual energy, and sending simple tasks to the low energy nodes. Hierarchy is constructed by broadcasting the route update messages. The hierarchy is built on the basis of the sequence of receiving messages. Hierarchal protocols construct node disjoint paths to avoid collision. The major difference between hierarchy protocols and energy-aware based protocols is that, in hierarchy based protocols the next hop is selected on the basis of the hierarchal relationship built during message exchange. While in energy-aware based protocols the next hop is selected from a group of neighbouring nodes, based on their energy level. The protocols in this category are described as follows.

protocols in this category are described as follows. the authors propose a special protocol, N-to-1 which discovers multiple paths from each node in only one route discovery process. For path discovery the base station periodically

broadcasts the route update message and each node receiving the update message for the first time will set the sender node as parent node. This process continues recursively until the packet reaches back to the base station. This approach will basically lead to a breadth first spanning tree with the base station as the root of the tree.

In the authors present a hierarchy-based multipath routing protocol (HMRP) which focuses on energy limitation in WSNs. The main objectives of this protocol are scalability, simplicity and extending system lifetime. In this work, multiple paths are constructed by broadcasting the message to neighbouring nodes. Each receiving node forwards the message to their neighbouring nodes and point them as their child node. This process continues until every node discovers its own children. In this architecture sink nodes act as root nodes. To make data transmission more reliable, each source node waits for acknowledgment from destination node before deleting the data from the buffer.

Ant Based Algorithm

Ant based algorithm is another infrastructure based approach which is used to build multiple paths. The algorithm is a population-based metaheuristic approach inspired from behaviour of real ants. The main idea behind this theory comes from observing the ability of ants to and the shortest path between the food source and the nest. Here is a brief example explaining the basics of this algorithm. An ant named 'xixi' roams independently in search of food. Once food is found, 'xixi' comes back directly to the nest leaving a trail of pheromones along the pathway. The rest of the ants follow the pheromone trail and use the same path to get to the food. On the basis of the working of the above algorithm two types of algorithms, AntNet algorithm and Ant-based control algorithm have been developed. In AntNet algorithm both forward ant and backward ant work together to grab the network information. The forward ants collect the node information and the backward ants utilize that information and update the routing table.

Joydeep Banerjee & Mrinal Kanti Naskar, Utpal Biswas

The author proposed a paper titled "Leader Selection in Wireless Sensor Networks an Energy Efficient Approach" in which they have stated that various limited energy of the wireless sensor node is always arise an issue in the routing protocol with energy efficiency and they proposed that a leader selection algorithm for these routing protocols to enhance the network lifetime to a greater extent. Distance of the node from base station, degree of connectivity of the node and trust level of the node is individually analyzed and is linearly combined with weights associated with each parameter. This gives the overall potential function of a node to become a leader. The number of rounds after which leader selection takes place is also equated. Through simulation the algorithm is compared with traditional energy-distance based method for routing protocols LBEERA, OREC, PEGASIS and SHORT. Significant improvement of network lifetime is obtained using this leader selection algorithm. Highest improvement of more than 8% increase in network lifetime is observed when distance of the node from the base station is given a higher linear combination weight.

They have worked with three major parameters in designing the protocol as listed below.

- Distance of the node from the sink
- Degree of the node
- Trust level of the node

Finally they have concluded stated that node form the base station, degree of connectivity of the node and trust level of the node coupled with its instantaneous energy determines the potential of a node to be a leader. They have mentioned for future work can be done to calculate or acquiring an optimal value for linear combination values at which the network lifetime enhancement is maximum.

Evripidis Paraskevas∗, Kyriakos Manousakis†, Subir Das† and John S. Baras

They have proposed a paper on working with energy routing protocol "Multi-Metric Energy Efficient Routing in Mobile Ad-Hoc Networks" in this paper they have taken into consideration multiple layer parameters, such as MAC queue utilization, node degree and residual energy. They integrate multi-metric routing scheme into OLSR, a standard MANET proactive routing protocol. The main observations are that in static and low mobility scenarios our modified routing protocol leads to a significant increase (5%-20%) in network lifetime compared to standard OLSR and slightly better performance in terms of Packet Delivery Ratio (PDR).

Optimized Link State Protocol (OLSR) is an optimization of link state routing protocol, which inherits the stability of a traditional link state algorithm and adds the advantage of its proactive routing nature to provide routes immediately when needed. In OLSR, like in all proactive routing protocols, the nodes periodically broadcast control packets (HELLO and topology control packets (TC)) to find their 1-hop neighbors and advertise a subset of their links. Upon receipt of these packets, each node calculates and updates routes to each known destination. The key concept of reducing the overhead in OLSR is the multipoint relays (MPRs)

The Algorithm is stated mainly three approached to reduce cost and to make it energy efficient:

MAC queue utilization:

This parameter indicates network congestion. When a mobile node has to transmit a lot of packets then this will lead to a significant energy consumption. Thus, larger weight should be assigned to nodes with high MAC queue utilization.

Residual energy:

This parameter is crucial in order to determine the next-hop node. The traffic should be directed to nodes that have enough residual energy to transmit. Hence, we should assign a large weight to nodes that have small residual energy to do forwarding.

Node Degree:

The degree of a node is the number of nodes that belong to its one-hop neighborhood. As we mentioned before, one reason for energy depletion is overhearing. We will try to avoid forwarding packets through nodes with high degree, because this will cause greater overall energy depletion. In addition, lower degree nodes also reduce the size of the interference graph, so fewer collisions will happen during our packet transmissions.

They used a weight-based routing scheme, where a weight is assigned dynamically at each node. Mobile nodes update their routing tables according to the path costs computed using the nodes' weights received at each time period. The metrics are normalized by their maximum values and they contribute additively to the node's weight computation with some multiplicative factors.

They have evaluated the Modified OLSR under a range of different scenarios, varying traffic load and mobility pattern. The Modified version of the OLSR achieves significant increase in network lifetime (5-20%), without loss of performance (in terms of PDR).

- In media streaming, the Internet's intrinsic heterogeneity continues a challenging problem. End users may have different edge bandwidth for data receiving or forwarding, especially in large-scale streaming with hundreds of thousands of users.
- Description coding rates have straightforward impact to the delivery performance. If a description has a high coding rate, some network paths may not have enough bandwidth to support its delivery. The loss rate of the description will be high. On the other hand, if descriptions have low coding rates, the number of descriptions and accordingly the coding cost will be high.

To get an expression for the effective potential of a node to be a leader, the parameters should be combined taking into consideration their dependency. The parameters ωD, ωN and $\omega\tau$ can be superposed linearly with individual weights α, β and γ respectively associated with them. This is so because the individual parameters are independent of each other (i.e. one parameter doesn't influence the value of other), the only difference being that one parameter may have higher priority in assigning leader selection protocol than the other.

The network lifetime increases across all the experiments. But for greater value of α, i.e. potential with respect to distance of the node from base station, increases the network lifetime to more than 8% for all routing protocol as evident . The lowest network lifetime increase is obtained when β is given a higher weight. This shows that leader selection protocol depends loosely on the degree of connectivity of the nodes. Optimization of the linear combination values for different routing protocols (it may happen that different routing protocol have different optimal linear combination value) is not included in this article and is left for future work.

III. RESEARCH FINDING

we investigate the main reasons that lead to energy depletion and we introduce appropriate routing metrics in the routing decision scheme to mitigate their effect and increase the network lifetime. For our routing scheme, we take into consideration multiple layer parameters, such as MAC queue utilization, node degree and residual energy. The modifications under a range of different static and mobile scenarios. The main observations are that in static and low mobility scenarios our modified routing protocol leads to a significant increase (5%-20%) in network lifetime compared to standard OLSR and slightly better performance in terms of Packet Delivery Ratio (PDR).

The proposed routing scheme takes into account three routing metrics to estimate the path cost and make the routing decision:

1. MAC queue utilization.
2. Residual energy.
3. Node Degree.

We are proposing our scheme in order to work and improve the properties of following parameters :

1. Packet Delivery Ratio.
2. Network Lifetime.
3. Average Node Residual Energy vs Time
4. Distribution of node residual energy

IV. OBJECTIVE

The main goal of our routing scheme is to increase the network lifetime, without loss of performance, and we use OLSR as a case study. For the purpose of this work, lifetime is defined as the time until the battery of any mobile node of our ad-hoc network depletes. We adopt this definition because, in the worst case, the depletion of a node may possibly cause network partition. To prevent the energy depletion and increase the network lifetime, we need to take into account cross layer parameters. These parameters include network congestion, residual energy of mobile nodes, as well as, network topology parameters. We aim to modify OLSR to make routing decisions according to these parameters and measure the performance improvement of our approach compared with the standard OLSR, using various performance metrics.

Our main Objective is in the improvement of following two things:

1. Packet Transmission rate in the network: each transmission causes energy consumption at the mobile node
2. Overhearing from the neighbour nodes:

Due to the broadcast nature of the wireless channel, all the nodes in the neighborhood of a sender node may overhear its packets transmission, even if they are not the receivers. Reception of these packets results to unnecessary expenditure of battery energy of the recipients.

V. PROBLEM FORMULATION

The problem of designing energy-efficient routing protocols has received significant attention by the research community for over a decade. Many energy-efficient routing schemes have been developed, which are typically based on residual energy derived metrics. In particular, a lot of research has been conducted on modifying standard routing protocols in MANET, such as AODV.

The problem of optimizing data aggregation precision for a practical type of WSNs where links are unreliable. For solving the problem, we have developed both centralized and distributed algorithms followed by analysis of algorithmic complexity and discussions of implementation issues. Numerical simulations were also conducted to demonstrate the convergence as well as the data aggregation precision performance of the proposed algorithms.

Ant based algorithm has many advantages in WSNs. Firstly, the underlying concept is really simple and it is a distributed approach in which multiple paths are discovered from all the possible areas. Hence, the traffic will be distributed evenly on the network which provides a better performance in terms of reliability and energy efficiency. Secondly, it is adaptive to any kind of network topology and even in system with a high dynamic environment this approach has a better successful rate. On the other side, the algorithm works really slow as compared to other heuristic approaches and in a high dynamic network the amount of overhead to and the shortest path is really high.

Geography-based Multipath Routing Protocols Geography-based protocols take the location information of the nodes into consideration. In such protocols the routing decision is based on the position of the source node, neighbouring nodes and the destination node. When an intermediate data routing node receives the data packet, it forwards the packet to the neighbour which is closest to the destination. Geography-based protocols have many advantages. Firstly, the nodes are not required to store the bulky neighbouring tables. This saves the memory space and the energy used to construct those tables. Secondly, there is no path maintenance required because the path is constructed with the arrival of the data packet, on the basis of neighbor's location and destination location. Finally, by considering the location of the nodes, the query can be distributed only to a certain required region instead of the whole network, which can save a number of transmissions.

METHODOLOY

- We propose an adaptive approach to adjust description coding rates according to the user bandwidth distribution.
- Our target is to provide the best streaming quality under certain network bandwidth constraint.
- We formulate the problem and address it by an adaptive solution.
- We would like to propose a scheme in which the optimal value can be auto generated such that the efficiency and computation can be decide auto according to the network situation and demand.

We would like to propose the algorithm in which the auto value for the selection alpha, beta, gamma can be obtain so that it can verify the network lifetime enhancement is maximum.

EXPECTED OUTCOMES

We are going to set proper and different parameters which required for the routing with energy efficiency and going monitoring the efficiency of the system in various terms:

1. Optimization problem with the network condition.
2. Robustness of the system, slowness of the system need to be enhance in the expected outcome simulation.
3. Less energy depletion should monitor in the proposed system work result.
4. Network life time increment based on the network environment conditions.

VI. CONCLUSION

In this work we have discussed various techniques where the unreliable links in wireless sensor networks are facing the problem of data optimization with accuracy and the problem to deliver the data in various links often get the issue of link failure and hence by obtaining the centralized system where the links and their routing techniques are centralized and aim to deliver data with high precision, and the paper solve the issues associated with the complexity and we take an initial step to overview the proposed multipath routing protocols in WSNs. We classify multipath routing protocols mainly based on whether the proposed routing protocol creates multiple path infrastructures or not. Furthermore, because of 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 synopsis, in our proposed work an optimal value for linear combination values at which the network lifetime enhancement is maximum need to be determined and need to be worked with the proposed technique.

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