New Energy Efficient Approach for Underwater Acoustic Networks

Manpreet Singh, Loveleen Kaur

Abstract: ***The Underwater acoustic network is the type wireless sensor network. The sensor network is deployed for sensing the environment conditions. Wireless sensor network is deployed on the far places like forests, deserts, underwater etc. The battery of the sensor node is limited, it is difficult to recharge or replace the battery of the sensor node. The underwater acoustic network is deployed inside the sea. In such type of environment, network interference is very high. In this paper, new technique is been proposed for reducing the power consumption of the sensor nodes and too enhance the network throughput.***

Index Terms: Underwater Acoustic Networks, under water Acoustic communications, Energy Efficiency, Robust, scalable, Cross layer Design

I. INTRODUCTION

Underwater acoustic networks are used for the communication purpose in ocean areas. This approach is used for the long distance ranging network. Underwater acoustic network are formed by establishing two ways acoustic link between various instruments such as autonomous and sensors. To increase the operation rang of autonomous underwater vehicles [3]. The feasible wireless communication rang of autonomous underwater vehicles is limited by acoustic rang of signal modem. Wireless underwater acoustic networking is the enabling technology for these applications. It consists of a variable number of sensors and vehicles that are deployed to perform collaborative monitoring tasks over a given area. To achieve this objective, sensors and vehicles self-organize in an autonomous network which can adapt to the characteristics of the ocean environment In this research various applications of underwater acoustic network are considered like better communication in which we focus on the information exchange between communicating nodes. The application of underwater acoustic network is environmental monitoring. In this UANs for pollution monitoring [4]. It's also used in underwater explorations. They can be easily done by UANs but difficult for human due to high water pressure.UANs are also used in Disaster prevention. It's done by deploying acoustic sensor network in remote locations. The different underwater activates like ocean-related disaster, tsunami are easily monitored by UANs . There are some challenges in the design of underwater acoustic networks like:

1. In underwater networks Propagation delay is five orders of magnitude higher then in radio frequency terrestrial channels, and extremely variable [6].
2. The available bandwidth is limited in underwater networks.
3. Due to multi-path and fading the underwater channel is severely impaired.
4. In underwater we have limited battery power. So we have to make them energy efficient.
5. To decreases the fouling from underwater sensors.
6. Due to the extreme characteristics of the underwater channel High bit error rates and temporary losses of connectivity can be experienced.

II. 2 UAN RESEARCH:

MAC layer, Network layer, physical layer and application layer are 4 different issues in UAN Network topology research [5].

Network topology: Due to uniqueness of underwater channels and characteristics of acoustic Signal UAN network is different from ground based networks. But the goals of both networks like increasing network capacity, reliable connectivity are same. The layout pattern of connections of various networks is known as network topology. Network topology has two basic types [1]. One is ad hoc mode and the is hierarchy mode. In ad hoc mode nodes are self organized as peer-to-peer network. But in hierarchy network topology several levels of structure are deployed.

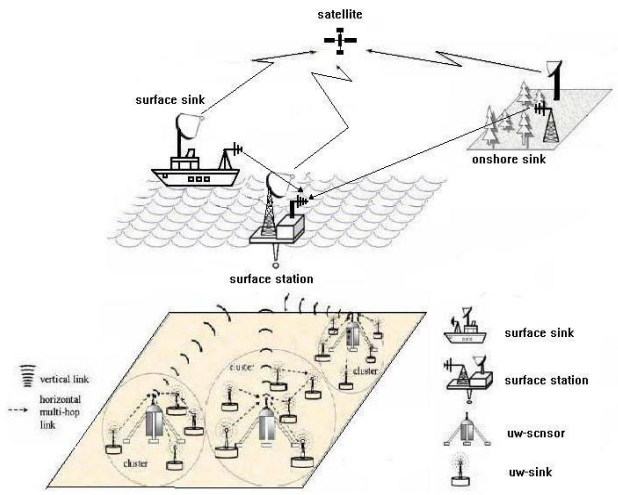

Fig 1: Hierarchy topology.

MAC layer: In network packets are move from one layer to another layer because of MAC layer. Underwater nodes have extremely-limited bandwidth, long delay so they share available resources.Medium access control layer is used to access the underwater acoustic channel [7]. MAC layer schedules each node to access physical medium. MAC layer

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also setup some parameters and determine resources that physical layer could have.

Network layer: Network layer contain the information about the routes. It's responsible for the routing packets and it contains the information of path between sender nodes to destination node. It's having two routing methods one is virtual circuit routing and the second is packet switch routing [8]. In first the network use virtual circuits to Decide the path between sender and receiver. And in second one every node that is part of transmission has its own routing decisions. Now the packet switching has further two types. One is proactive routing and another is reactive routing.

Physical layer: Physical layer link with basic hardware and hardware transmission technologies. UAN is unique because of physical channel [2]. For underwater channel electromagnetic wave band have high attenuation but go through only small parts of long-wave bands. So here we need a large antenna and high transmission power. The communication is done in underwater with acoustic signal because acoustic signals can travels at long distance in underwater.

Application Layer: Application layer provides the network management protocol. This layer is used for the problem partitioning and resource allocation [10]. It s also use for Synchronizing communication, detecting resource availability and identifying communication partners.

III. ARCHITECTURE OF UANS

There are many unsolved issues in underwater acoustic networks. UANs are Different from ground based networks. The bandwidth of UANs is limited as compare to ground based networks [9]. But the acoustic signals are having High frequency and rang. UANs have long progress delay. Acoustic signal have Transmission speed is around 15000m/s which is lower then electromagnetic Wave so it delays in progress. Probability of Bit error high in cause of UANs. In UANs cost of manufacturing, deployment, recovery and maintained is very high as compare to ground based networks. UANs are design for the long time work and energy saving.

IV. PROPOSED WORK

The proposed technique is based on the clustering and signal strength. The whole network which is deployed will be divided into the finite number of clusters. The source nodes which sense any event in the environment will forward the sensed data to the sink. The sink will broadcast the data on the internet. The source nodes will pass data to the sink with the help of intermediate nodes the every node in the network will present its signal strength. The source when wants to send the data to the sink. First the source node will forward the data in its cluster. If the path doesn't exits with in the cluster, then the data will be sends to the node for passing the data to the sink. The simulation results show that proposed technique is much than the previous technique

V. SIMULATION

Robust, scalable and energy efficient routing are fundamental problems in underwater sensor networks (UWSNs). High latency low bandwidth, high error Probability, node float mobility is the things that differenced the UWSNs from terrestrial sensor network. There are still many challenges to the network protocol design of UWSNs. Vector based forwarding protocol provide robust, scalability and energy efficient routing. It's a location based approach in which no state information is required on the sensor node and the packets are forwarded in interleaved path which is increase the robustness in VBF. Here we develop the self-adoption algorithm which enhances the performance of VBF.

This algorithm allows nodes to reduce energy consumption and forward packets by discarding the low benefit packets. We evaluate the results on simulations. Our results for network with medium or small node mobility (1 m/s-3 m/s), and it shows the enhancement in high success Of data delivery, energy efficiency and robustness.

VI. PERFORMANCE EVALUATIONS

We did simulation in NS-2 to evaluate the performance. First we implement MAC protocol and then define simulation methodology. We evaluate the effect of node mobility, node density, routing pipe radius on VBF.

Methodology: The whole network is divided into the fixed size clusters. Every node in the cluster presents its signal strength value corresponding to other nodes. When any node wants to communicate with the sink, it first checks, the nodes which are in their cluster that whether they are reachable to sink or not. If the path to destination will not be established through inter cluster communication, and then intra-communication can be done. The route between source and destination will be established on the basis of signal strength. In figure 1 and 2 the results of the proposed technique shows in the form of graphs

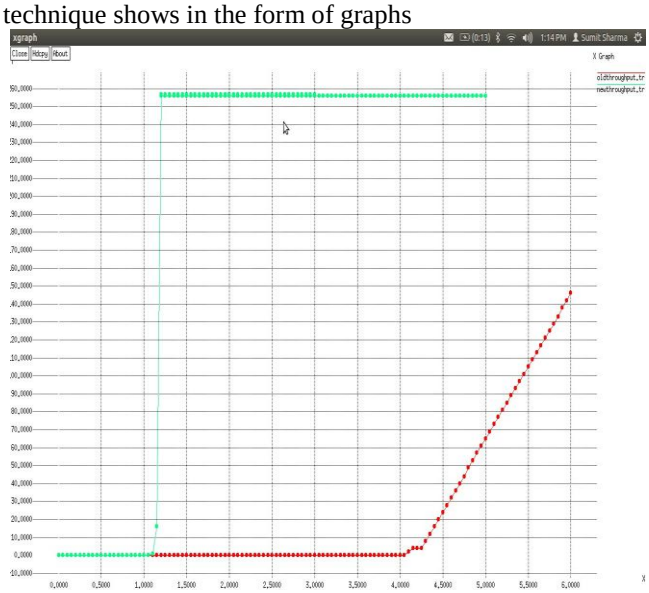

Fig 2: Comparison graph of throughput

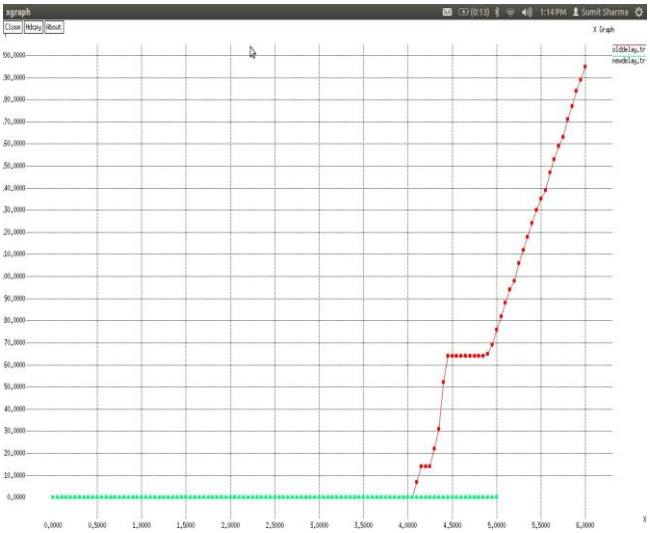

Fig 3: Comparison graph of delay

VII. CONCLUSION AND FUTURE WORK

Here we proposed a vector-based forwarding (VBF) protocol to address the routing challenges in UWSNs.

1. It's scalable in terms of network because no state information is required at nodes.
2. It's also energy efficient because only the nodes which are close to routing vector are used in data forwarding.
3. For providing robustness against packet loss and node failure it uses path redundancy.

Future work: UWSNs have several directions for future investigation like MAC protocol is used as underlying link layer protocol which is not satisfactory choice. We can design the efficient MAC protocol for underwater sensor networks. And we can also work on high end-to-end delay, low bandwidth for congestion control and reliable data transmission.

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