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Comprehensive Overview of Different Mac Protocols Used In Underwater Communication

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Abstract- Large scale mobile underwater wireless sensor networks (UWSN) is a novel networking paradigm to expose acoustic environment the characteristics of mobile .The architecture of UWSN is vulnerable to various issues such as large propagation delays, floating of sensor nodes limited link capacity multiple message recipients due to the reflection on sea ground and sea surface. To overcome the vulnerability the paper discuss about various survey about efficiency, bandwidth and localization. Underwater wireless sensor networks (UWSN) unlike commencement of terrestrial sensor networks faces dissimilar challenges such as limited bandwidth, low battery power, defective underwater channels and high variable propagation delays .A vital problem in UWSN is finding an efficient route between source and a destination .Several routing protocols are anticipated for these issues and can be classified into geographic and non-geographic routing protocol. The foremost focus is on reviewing and comparing algorithms projected recently in literature.

Index Terms- *:* Underwater wireless sensor networks, Autonomous underwater vehicles, Medium access control

1. INTRODUCTION

Underwater Wireless Sensor Network (UWSN) is a network in which the primary portion is built underwater. It primarily consists of a number of underwater sensor nodes, underwater sink, surface station, autonomous underwater vehicles (AUVs) deployed mutually to perform a collaborative monitoring and resource examination tasks over a given area. The exploitation of both distributed and scalable sensor network provides a 3-dimensional underwater space; each underwater sensor can detect and monitor environmental parameters dealings locally [1][3]. In contrast to remote sensing ,underwater sensor networks provides a better surveillance and sensing technology gaining better data to understand a spatial and temporal complexities of underwater environments.

Underwater communication system involves transmission of information in the provisions of sound, optical or electromagnetic [2] (EM) waves. Together with the sensor technology and vehicular technology, wireless communications enables new applications ranging from environmental monitoring to gathering of oceanographic data and marine archaeology. The underwater sensor networks uses signals to carry digital information through underwater channel , radio signals are not been used as electromagnetic waves travels through extremely Short distances, to trounce these drawbacks acoustic channel are be used. Acoustic channel consists of three distinguishing characteristics such as frequency-dependent propagation loss, severe multipath, and low speed of sound propagation [3][1]. These constraints results in communication channel of poor quality and high latency, thus combining the worst aspects of terrestrial mobile and satellite radio channels hooked on a communication medium of extreme difficulty. With advance in acoustic modems technology, sensor technology and vehicular technology, ocean engineering today is stirring towards integration of these components into autonomous underwater networks

1.1 C*entralized and decentralized underwater networks:*

While the current applications consist of supervisory control of individual AUVs, and telemetry of oceanographic data from bottom-mounted instruments, the apparition of potential is that of a digital ocean in which integrated networks of instruments, sensors, robots and Vehicles motivation operate together in a variety of underwater environments [3]. Underwater networks are to be expected to evolve in two directions: centralized and decentralized networks. In centralized networks nodes communicate through base station that covers one cell. Large areas are covered by more cells whose base stations are connected over a take at a distance communication infrastructure. The base stations are surfaced and they provide communication using means of communication links, the base stations are movable as well. In case of decentralized network node communicate with a peer-to-peer, multihop transmission of data packets.
Reach the destination; the nodes form a cluster for a more efficient utilization of communication channel.

One of the major aspects of the evolving underwater networks is the requirement, of scalability A method for channel sharing is scalable if it [1][5]is equally applicable to any number of nodes in a network of given density. The need for underwater acoustic telemetry exists in applications such as data harvesting for environmental monitoring, communication between manned and unmanned underwater vehicles, transmission of diver speech etc.

Acoustic communications form an active field of research with significant challenges to overcome, especially in horizontal, shallow water channels. Compared with radio telecommunications the available radio telecommunications, the available bandwidth is reduced by several orders of magnitude. The low speed of Sound causes multipath propagation to stretch over time delays intervals of tens or hundreds of milliseconds as well as significant Doppler shifts and spreading .however adhoc. The low speed of sound causes multipath propagation to stretch over time delay intervals of tens or hundreds of milliseconds as well as significant Doppler shifts and spreading. However acoustic communications are not limited by noise but by reverberation and time variability beyond the capability [1][2][3] .The fidelity of underwater communications links can be greatly improved by the use of hydrophone arrays which allow processing Techniques such as adaptive beam forming and diversity combining.

2. LITERATURE SURVEY

Localization in underwater sensor networks surveys and challenges: Underwater sensor networks (UWSNs) determining the every sensor nodes location .the main process involves estimating the location of each node in a sensor network known as localization. The characteristics of underwater sensor networks are fundamentally different from that of a terrestrial networks. Underwater acoustic channels are characterized by harsh physical layer environments with stringent bandwidth limitations The variable speed of sound and long propagation delays .the aim of the project is to meet the challenges required by the emerging applications e.g.: offshore engineering. The problem of localization in underwater sensor networks poses a new set of challenges because of the acoustic transmission medium. The UWSNs are broadly classified into ranged based and range free schemes. Many of the localization schemes and their performance need to be evaluated in underwater systems.[4] Localization in the application domain of UWSNs in offshore engineering.

A Survey of Existing Medium Access Control (MAC) for Underwater Wireless Sensor Network (UWSN): Try to achieve better bandwidth utilization while Reaching further transmission distance in an Underwater wireless sensor networks (UWSN) consist of a number of nodes that certainly interrelate to send the sensed data to the sink node the stage collaborative tasks. However UWSN is typically chooses acoustic as a intermediary for communication for wireless transmission. Electromagnetic waves recommend a great merit in special underwater environment such as shallow water. UWSN is extensively different from terrestrial sensor networks in many aspects such as mobility of sensor nodes due to water current, propagation delay and propagation loss .These distinctions feature of underwater sensor network grounds many new challenges for delivering information from sensor nodes to sink node effectively in UWSN[5].

To achieve reliable data transfer in underwater sensor network scenarios, a new event Mac protocol need to be urbanized to endow with energy efficient and reliable upstream. Data reliability of a sensor node is described as a probability of data packet being delivered from sensor node to the sink.MAC protocol consequently essential to advance the reliability of data delivery for competent underwater communication and to enhance water monitoring and exploration applications .To pull off that MAC protocol should provide collision avoidance and energy efficiency for managing and controlling communications channels which are shared by many nodes to avoid collisions and maintain reliable transmission conditions[6]. On the other furnish, transport protocol will be provided with an end to end reliability, congestion control and also energy efficiency

Underwater Acoustic Wireless Sensor Networks: Advances and Future Trends in physical, MAC and routing layers aims to provide a comprehensive overview of the current research on underwater wireless sensor networks,[5] focusing on the lower layers of the Communication stacks, and envisions future trends and challenges .it analyzes the current state of the art on the physical, medium access control and routing layers. It summarizes their security threads and surveys. Current envisioned niches for further advances in underwater networks research range from efficient low power algorithms and modulations to intelligent energy aware routing and medium access control protocols. A comprehensive view of the current state of the art in UWSNS by analyzing the current research status of the physical, MAC and routing layers .the interaction of these layers is essential in order to advance the research and development of UWSNS .Hence each layer must account for the advances of the others and use them to its advantage. On the physical layer, further research should be conducted to implement complex algorithms and modulations in low-power, low-cost microcontrollers. These algorithms should

Energy efficient manner. On line of action can be reducing the bit error rate by developing efficient multipath and Doppler correction algorithms ,as well as efficient error correction mechanisms. At the same time research on applying modulations with high spectral efficiency for UWSN and high bandwidth piezoelectric transducers should be conducted.

A MAC protocol for Ad-Hoc Underwater Acoustic Sensor Networks: A medium access protocol is proposed that is suitable for non -synchronized ad-hoc networks and in particular for energy-constrained underwater acoustic networks characterized by long propagation delays. The protocol exploits the difference in the link lengths between the nodes instead of using waiting times proportional to the maximal link length. By minimizing the length of handshake procedure preceding the data transmission the throughput efficiency is increased as compared to the previously proposed protocol while collision avoidance minimize the energy consumption. Channel sharing for ad-hoc underwater networks which saves energy by avoiding collision while maximizing throughput. The Throughput of the MAC protocol for Ad-Hoc Underwater acoustic sensor network is several times higher the one achieved with slotted FLAMA. While offering similar protection to collision i.e. savings in energy when the range is reduced or load is increased the protocol based on hand shake mechanism improve their throughput efficiency.

Challenges: Building scalable mobile underwater wireless sensor networks for aquatic applications. Large scale mobile underwater wireless sensor networks (UWSN) is a novel networking paradigm to explore aqueous environments. However the characteristics of mobile UWSNs, [5] Such as low communication bandwidth large propagation delay, floating node mobility and high error probability are significantly [7]. Analyzing split channel medium access control schemes with ALOHA Reservation: In order to improve the throughput performance Medium Access Control (MAC) schemes in wireless communication networks .The control sub channel used for access reservation to the data sub channel over which the data packets are transmitted and such reservation can be done through RTS/CTS (Request to send /clear to send) scheme. In this paper we evaluate the maximum achievable throughput of split channel MAC schemes based on RTS/CTS dialogue with pure aloha contention resolution mechanism

Analyzing multi-channel MAC protocols for underwater acoustic sensor networks: Multi channel MAC protocol the model analyzes two generalized multi channel MAC protocols: multi channel with aloha on a dedicated control channel and multichannel access with RTS/CTS on a dedicated control channel. Through long delay feature of underwater acoustic channels drastically increases [7] the complexity of the theoretical analysis of the RTS/CTS protocol, manage to develop tight upper bound and lower bound systems for it [8]. Through simulations we show that the theoretical comparison system performance. Comparing simulation to compare the two investigated protocols. Results demonstrate that the RTS/CTS protocol out performs the ALOHA protocol in most cases while the later is most robust in dynamic network condition. MAC protocols for long delay underwater acoustic sensor networks. Two generalized protocols :Multi-channel with aloha and multi-channel with RTS/CTS are modeled, analyzed and compared .Through the long delay feature of underwater acoustic channel greatly complicates the theoretical analysis for the multichannel with RTS/CTS scheme ,the successfully developed tight upper bound and lower bound. Through simulations we show that our theoretical analysis can closely estimate the system performance. Further simulation results demonstrate that in most cases, although ”aloha” simplifies the protocol design it cannot provide good system performance in terms of both throughput or energy efficiency .intricate control such as RTS/CTS like channel reservation can significantly augment the system performance even in long delay underwater environments. on the other hand “aloha” can achieve stable performance with varying propagation delays, This suggests that it is more suitable for dynamic network conditions.

Purpose and Methodology	**Merits**	**Demerits**	**Application**
Localization in underwater sensor networks-surveys and challenges Is the process of estimating the location of each node in a sensor network. The different localization algorithms are used to meet the requirement posed by the emerging application	Simplicity and range free schemes.	Extreme source of noise	Ecosystem monitoring and oil drilling
Analyzing Multi-channel MAC protocols for underwater acoustic sensor networks. Analyzing two generalized multi channel MAC protocols mutli channel access with aloha on a dedicated control channel and multi channel access with RTS/CTS on a dedicated control channel.	Robust in dynamic network conditions.	Does not Provide good system performance in terms of both throughput or energy efficiency	Commercial exploitation and coastline protection.
A survey of Existing Medium Access Control (MAC) for underwater wireless sensor network (UWSN). The main methodology is to improve the reliability data delivery for efficient underwater communication to enhance water monitoring and explorations applications	Reduces energy waste in idle time and overhearing	Transmission delay and noise.	Radio frequency and radio communication.
Analyzing split channel medium access control schemes with ALOHA reservation .To evaluate the maximum achievable throughput of split channel MAC schemes that are based on RTS/CTS scheme with pure ALOHA contention mechanism	Better throughput	Cannot generate a successful channel reservation scheme within a period of time	message transmission
Challenges: Building scalable mobile underwater wireless sensor networks for aquatic applications uses a top-down approach to explore the research challenges in UWSN design.	Low-cost and densely deployed sensors	Not longer feasible as the commonly available RF signals fails underwater	Routing and traffic observation
Analyzing multi-channel multi-channel MAC protocols for underwater acoustic sensor networks.	Throughput and energy consumption.	Does not provide good system performance.	Commercial exploration and coastline protection.

TABLE 1: COMPARSION OF DIFFERENT UNDERWATER ACOUSTIC SENSOR NETWORKS.

3. CONCLUSION

Underwater wireless sensor networks (UWSN) unlike commencement of terrestrial sensor networks faces dissimilar challenges such as limited bandwidth, low battery power, defective underwater channels and despite the fact that in view of the unique characteristic of underwater communication. Several high variable propagation delays .A vital problem in UWSN is finding an efficient route between source and a destination .Accordingly, great efforts enclose been prepared for designing competent protocols

routing protocols are anticipated for these issues and can be classified into geographic and non-geographic

routing protocol. The foremost focus is on reviewing and comparing [9] algorithms projected recently in literature.

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