Chapter 6
Congestion Control Protocols for UWSNs

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ABSTRACT

UWSN is a grid of many purposes of self-operating nodes with various applications related to various disciplines such as hydrographic surveys, tactical surveillance, disaster prevention, and bathymetry. The process of transmission and reception of messages by propagating sound in an underwater environment is known as acoustic communication. Transmission of acoustic waves is the only method to communicate underwater, as radio waves get attenuated severely and there is severe scattering in optical transmission. Underwater wireless sensor networks (UWSN) have important applications in the exploration of underwater. UWSNs have various applications like in exploration of the sea, collection of data, monitoring of pollution, surveillance of tactics, prevention of disaster, in applications of ministry and surveying of mines.

INTRODUCTION

In UWSN, Underwater sensor nodes are designed in such a way so that it can tolerate the severe environment of the deep seas to work well for longer time without having to repair, service, or recharge. Since these nodes are incapable to show lateral movement independently, they should be arranged in space optimally.

Underwater sensor networks nodes are not fixed like ground-based sensor network nodes .Instead, they mobilize because of activities of underwater environment.

These waves are waves related to pressure that show transverse movement in medium. They suffer from attenuation losses and spherical spreading because of signal characteristics and medium .Underwater Sensor Networks has constraints like limitation in bandwidth, delay in propagation, 3Dtopology, and constraints in power and congestion .This chapter deals with congestion control in UWSN.(Jain 2015)

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BACKGROUND

Issues, Controversies, Problems

A WSN contains many kinds of nodes. These nodes face various challenges. Some of them are: limitation in availability of energy, throughput and communication ability. UWSNs are complex. In this world, networks send data to the base-station. UWSNs have many characteristics which differ from TWSN (Terrestrial Wireless Sensor Network). This medium has limitation in bandwidth, consumes more energy for transmission and delay is longer. (Awan 2019)

Therefore, the characteristics of underwater acoustic sensor networks show that these networks need congestion control protocols. A transmission medium broadcasts to all neighboring nodes that can receive signal. In this a node may not get some packets at the time of transmission because transmitter and receiver perform in half duplex mode which communicates simultaneously on one channel. So the node may not detect a collision. Therefore protocols have to be designed otherwise collision will occur in the channel.

In UWSN, conservation of energy is an important concern because it causes difficulty in charging of the battery .Consumption of energy in UWSN is required at the time of transmission and reception of data which is done for the entire week. In UWSN loss of energy can occur by re-transmitting data due to conflict, implosion and overlap, control packet overhead, unnecessary usage of power in standby mode. Research is going on to lessen the energy wastage.

UWSN nodes are sparsely deployed and there is possibility of congestion. Network congestion takes place at the time of exceeding of capacity of load on the node, this can result into drop of packets, delay of queues or blockage of new connections and interferences of packets .This results in the reduction of throughput in the network. The result is the reduction in throughput. This might result in many retransmissions so that packet loss can be compensated which may lead to the congestion. For the accomplishment of the mission of the network, the QoS should be improved, and hence congestion control becomes important.

Congestion Control Schemes

The MAC Protocol for Single-Hop (Centralized)

This scheme has been suggested because of the various features of underwater channel which are

1. Battery supply is difficult
2. The propagation delay is long, and
3. The data transfer rate is low.

Media Access Control Protocol (MAC)

The single-hop (centralized) has been considered. This contains member nodes and single head node in the cluster. Here all nodes which are member of this network are connected to the head node (cluster) by a hop (single). In this scheme two phases are there which are shown in Figure. 1. (Byun 2013)