# POWER EFFICIENT DATA DISSEMINATION IN UNICASTING OF UNDERWATER SENSOR NETWORK

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## ABSTRACT

*Multipath Wireless Sensor networks are envisioned as tiny power constrained devices, which can be scattered over a region of interest, to enable monitoring of that region for an extended period of time. To Preserving coverage and connectivity in underwater sensor network has been a problem that has been addressed in the past. To proposed the use of directional antennas or localization infrastructure. Given that sensors are envisioned to be light-weight energy constrained devices, it may not be desirable to equip them with such additions. This work considers a scheme that ensures coverage and connectivity in a sensor network, without the dependence on external infrastructure or complex hardware.*

***Keywords: MANET, Underwater Sensor Network, EERP (Energy Efficient Routing Protocol), GAF (Geographic Adaptive Fidelity).***

## I. INTRODUCTION

The wireless sensor networks of the near future are envisioned to consist of hundreds to thousands of inexpensive wireless nodes, each sensing capability and computational power. They are intended for a broad range of environmental sensing applications from vehicle tracking to habitat monitoring. The hardware technologies for these networks – low cost processors, miniature sensing and radio modules – are available today, with further improvements in cost and capabilities expected within the next decade. The applications, networking principles and protocols for these systems are just beginning to be developed.

Sensor networks are quint essentially event-based systems. A sensor network consists of one or more “sinks” which subscribe to specific data streams by expressing interests or queries. The sensors in the network act as “sources” which detect environmental events and push relevant data to the appropriate subscriber sinks. Because of the requirement of unattended operation in remote or even potentially hostile locations, sensor networks are extremely energy-limited. However since various sensor nodes often detect common phenomena, there is likely to be some redundancy in the data the various sources communicate to a particular sink. In-network filtering and processing techniques can help to conserve the scarce energy resources.

## II. RELATED WORK

When η identical randomly located nodes, each capable of transmitting at W bits per second and using a fixed range, form a wireless network, the throughput λ(n) obtainable by each node for a randomly chosen destination is $\Theta\left(W|\sqrt{n\log n}\right)$ bits per second under a noninterference protocol. If the nodes are optimally placed in a disk of unit area, traffic patterns are optimally assigned, and each transmission's range is optimally chosen, the bit-distance product that can be transported by the network per second is $\Theta\left(W\sqrt{An}\right)$ bit-meters per second. Similar results also hold under an alternate physical model where a required signal-to-interference ratio is specified for successful receptions. Splitting the channel into several sub channels does not change any of the results. Since the throughput furnished to each user diminishes to zero as the number of users is increased, perhaps networks connecting smaller numbers of users, or featuring connections mostly with nearby neighbors, may be more likely to be find acceptance [1]. The capacity of ad hoc wireless networks is constrained by the mutual interference of concurrent transmissions between nodes. Study a model of an ad hoc network where nodes communicate in random source–destination pairs. These nodes are assumed to be mobile. Examine the per-session throughput for applications with loose delay constraints, such that the topology changes over the time-scale of packet delivery. Under this assumption, the per-user throughput can increase dramatically when nodes are mobile rather than fixed. This improvement can be achieved by exploiting a form of *multiuserdiversity* via packet relaying. [2]. This work provides a general framework for the analysis of the capacity scaling properties in mobile ad-hoc networks with heterogeneous nodes and spatial in homogeneities. Existing analytical studies strongly rely on the assumption that nodes are identical and uniformly visit the entire network space. Experimental data, however, have shown that the mobility pattern of individual nodes is typically restricted over the area, while the overall node density is often largely inhomogeneous, due to prevailing clustering behavior resulting from hot-spots. Such ubiquitous features of realistic mobility processes demand to reconsider the scaling laws for the per user throughput achievable by the *store-carry-forward* communication paradigm which provides the foundation of many promising applications of delay tolerant networking. We show how the analysis of the asymptotic capacity of dense mobile ad-hoc networks can be transformed, under mild assumptions, into a *Maximum ConcurrentFlow* (MCF) problem over an associated *Generalized RandomGeometric Graph* (GRGG). Our methodology allows to identify the scaling laws for a general class of mobile wireless networks, and to precisely determine under which conditions the mobility of nodes can indeed be exploited to increase the per-node throughput. At last we propose a simple, asymptotically optimal, scheduling and routing scheme that achieves the maximum transport capacity of the network.

This work extended the analysis of the capacity scaling properties in mobile ad-hoc networks by considering heterogeneous nodes and spatial in homogeneities, two common features widely recognized in realistic mobility traces. The main problem onto a *Maximum Concurrent Flow* (MCF) problem over an associated *Generalized Random Geometric Graph* (GRGG). Our methodology allows to identify the scaling laws of a general class of mobile wireless networks, and to precisely determine under which conditions the mobility of nodes can indeed be exploited to increase the per-node throughput. Finally GRGG and MCF are considering to identifying the scaling laws are using in it [3].

## III. PROPOSED SYSTEM

Heterogeneous under water sensor networks with infrastructure support:

### 3.1 Two-dimensional hybrid random walk model

Consider a unit square which is further divided into $1=B2$ squares of equal size. Each of the smaller square is called a RW-cell (random walk cell), and indexed by $(Ux;Uy)$ where $Ux;Uy \in \{1; : : : ; 1=B\}$. A node which is in one RW-cell at a time slot moves to one of its eight adjacent RW-cells or stays in the same RW-cell in the next time-slot with a same probability. Two RW-cells are said to be adjacent if they share a common point. The node position within the RW-cell is randomly and uniformly selected.

**3.2 Mobility Time Scales:** Two time scales of mobility are

**3.2.1 Fast mobility:** The mobility supports high speed IP packet data only. Random way point mobility with 3 speeds of 1m/s,10m/s,20m/s. Wireless local area network are using WIFI is IEEE 802.11b MAC(Message Authentication Code) and packet size is 512 bytes. The mobility of nodes is at the same time scale as the transmission of packets, i.e., in each time-slot, only one transmission is allowed. Fast mobility environments, a typical GOOD duration are 0.06 seconds (about 6 packet transmission times).

**3.2.2 Slow mobility:** The mobility takes low bandwidth and low propagation delay. The packet loss probability (for 1k byte packet) ranging from 0.15 to 0.001.The slow mobility bandwidth ranging from 50 Kbit/s to 1.5 Mbit/s. The GOOD state has low packet loss probability say $10^{-2}$. The BAD state has a high packet loss probability, say 1. The mobility of nodes is much slower than the transmission of packets, i.e., multiple transmissions may happen within one time-slot. A slow mobility environment, a typical GOOD duration is 0.12 seconds (or about 128 packet transmission times).

### 3.3 Scheduling Policies

Assume that there exists a scheduler that has all the information about the current and past status of the network, and can schedule any radio transmission in the current and future time slots, similar. A packetis successfully delivered if and only if all destinations within the multicast session have received the packet. In scheduling policies mainly using protocol is Energy Efficient Routing Protocol (EERP). The Proposed protocol is implemented with the object oriented discrete event simulator. In our simulation, 50 mobile nodes move in a 1200 meter x 1200 meter square region for 50 seconds simulation time. We assume each node moves independently with the same average speed. All nodes have the same transmission range of 250 meters. The simulated traffic is Constant Bit Rate (CBR).

Simulation settings and parameters are summarized in table

| | |
|---|---|
| No. of Nodes | 50 |
| Area Size | 1200 x 1200 $m^2$ |
| MAC | 802.11 |
| Radio range | 250 m |
| Simulation Time | 50 sec |
| Traffic Source | Constant Bit Rate(CBR) |
| Packet Size | 512 bytes |
| Mobility Model | Random Way Point |
| Maximum & Minimum Speed | 10 & 0.5 m/s |

**3.3.1 Throughput and delay:** Throughput is generally measured as the percentage of successfully transmitted radio-link level frames per unit time. Transmission delay is defined as the interval between the frame arrival time at the MAC layer of a transmitter and the time at which the transmitter realizes that the transmitted frame has been successfully received by the receiver.

**3.3.2 Data packet delivery ratio:** The data packet delivery ratio is the ratio of the number of packets generated at the sources to the number of packets received by the destinations.

**3.3.3 End-to-end delay:** This metric includes not only the delays of data propagation and transfer, but also all possible delays caused by buffering, queuing, and retransmitting data packets.

**3.3.4 Consumption per Packet:** It is defined by the total energy consumption divided by the total number of packets received. This metric reflects the energy efficiency for each protocol.

**3.3.5 Energy efficiency:** Energy efficiency can be defined as

$$\mathit{Energy\ Efficiency} = \frac{\mathit{Total\ no.of\ bits\ transmitted}}{\mathit{Total\ Energy\ Consumed}}$$

In each time slot, for each packetthat has not been successfully delivered and each of its unreached destinations, the scheduler needs to perform the following two functions:

## 3.4 Capture

The scheduler needs to decide whether to deliver packet to destinationin the current time slot. If yes, the scheduler then needs to choose one relay node (possibly the source node itself) that has a copy of the packetat the beginning of the timeslot, and schedules radio transmissions to forward this packet to destination within the same timeslot, using possibly multi-hop transmissions. When this happens successfully, say that the chosen relay node has successfully capturedthe destination of packet. Call this chosen relay node the lastmobile relayfor packet and destination. Call the distance between the last mobile relay and the destination as the capture range is 124 mi is equal to 248 miles. Range is the maximum range possible to receive data at 25% of the typical rate.

### 3.5 Duplication

For a packet *p* that has not been successfully delivered, the scheduler needs to decide whether to duplicatepacketto other nodes that does not have the packet at the beginning of the time-slot. The scheduler also needs to decide which nodes to relay from and relay to, and how. All transmissions can be carried out either in ad hoc modeor in infrastructure mode. We assume that the base stations have a same transmission bandwidth. The bandwidth for each mobile ad hoc node is denoted by packets. Further, we evenly divide the bandwidthinto two parts, one for uplink transmissions and the other for downlink transmissions, so that these different kinds of transmissions will not interfere with each other.

**Uplink:**A mobile node holding packetis selected, and transmits this packet to the nearest base station. Uplink is using High Speed Packet Access (HSPA) the average upload is 600 kbps to 1.5mbps. WIFI of 802.11a, 802.11b, and 802.11g of uplink is 54 the range is ~30 m and 802.11n of downlink is 600 the range is ~50m.

**Infrastructure relay:**Once a base station receives a packet from a mobile node, all the other *m* base stations share this packet immediately, (i.e., the delay is considered to be zero) since all base stations are connected by wires.

**Downlink:**Each base station searches for all the packets needed in its own sub region, and transmit all of them to their destined mobile nodes. At this step, every base station will adopt TDMA schemes to delivered different packets for different multicast sessions. Finally a rate present is 2 Mbit/s to 200 Kbit/s. WIFI of 802.11a, 802.11b, and 802.11g of downlink is 54 the range is ~30 m and 802.11n of downlink is 600 the range is ~50m.

## IV. GAF (GEOGRAPHIC ADAPTIVE FIDELITY) PROTOCOL

In GAF protocol, each node uses location information based on GPS to associate itself with a “*virtual grid*” so that the entire area is divided into several square grids, and the node with the highest residual energy within each grid becomes the master of the grid. Other nodes in the same grid can be regarded as redundant with respect to forwarding packets, and thus they can be safely put to sleep without sacrificing the “*routing fidelity*” (or routing efficiency).

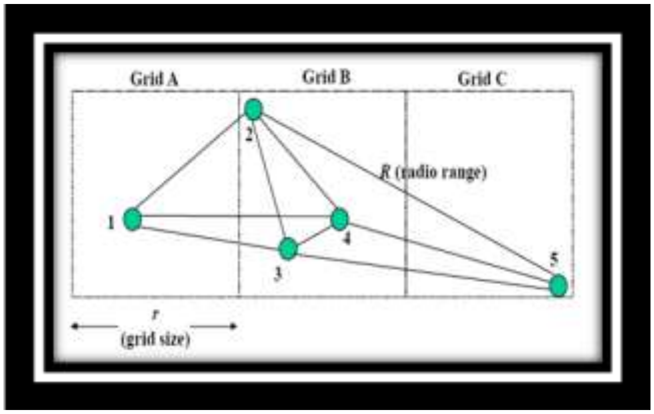

**Fig 4.1 Virtual grid structure in the GAF protocol**.

Master election rule in GAF is as follows. Nodes are in one of three states as shown in Figure: *sleeping*, *discovering* and *active*. Initially, a node is in the discovery state and exchanges discovery messages including grid IDs to find other nodes within the same grid.

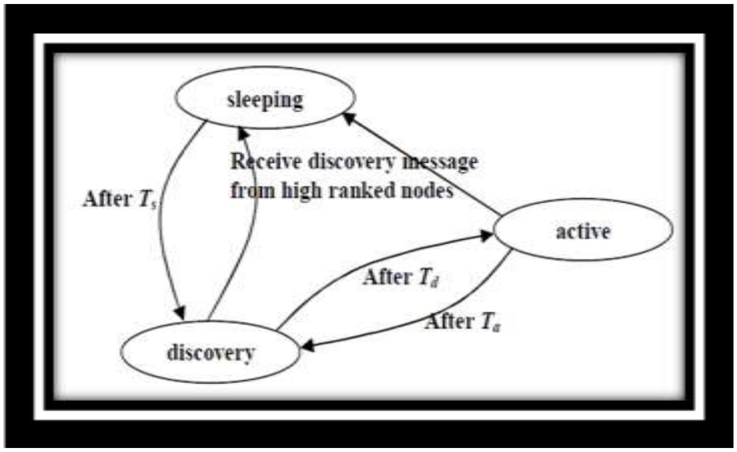

**Fig 4.2 State Transition in the GAF Protocol**

## V RESULT AND DISCUSSION

Optimization ACO due to its distributed nature becomes alternate to GAF, in order to determine the optimal route it needs that the base station already has the required information. For fusion process neural networks are well suited because neural networks can learn and dynamically adaptive to the changing scenarios. Reinforcement learning is fully distributed and it can adapt quickly to network topology change or any node failure. It has been used efficiently for finding the optimal path for aggregation. GAF based distributed approach using sleep state switching numbers and weighted average operators to perform energy efficient flooding-based aggregation has also been proposed and the system outperforms the previous results. In wireless sensor networks many situations demand aggregating data at a central node e.g. monitoring events. For these situations, the centralized approaches like ACO can be used efficiently to know the features of the data are shown in the figures.

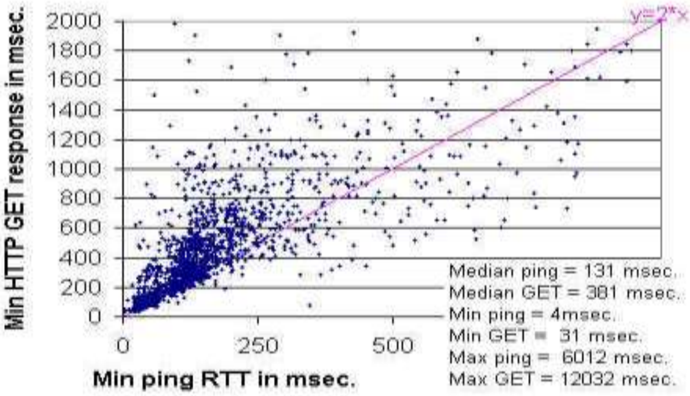

**Figure 5.1.Finding distance**

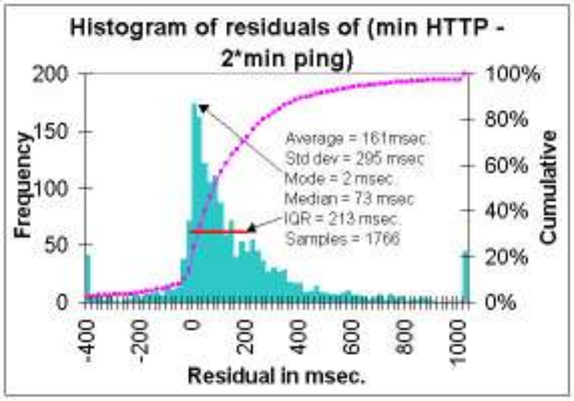

**Figure 5.2.Transmission Delay**

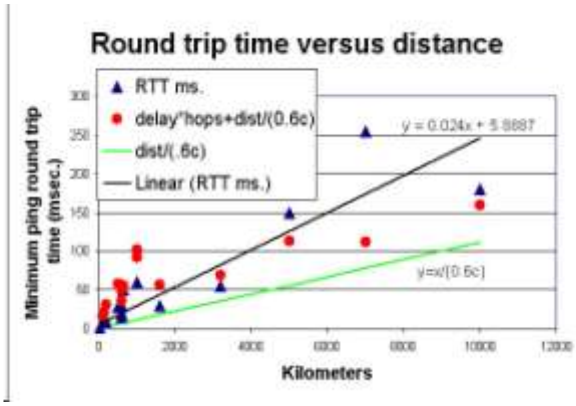

**Figure5.3.Data Loss Deduction**

This analysis includes calculating percentage of energy conserved in this protocol as well as the previously known protocol. Further time spend by each node in the sense, transmit, off states are calculated for each node. Based on the above results, power consumption of each node in their corresponding state is calculated. Total power consumed by a single sensor node is calculated based on the individual power consumed by the corresponding node in the sense, transmit, off states. Total power consumption of the entire process is calculated based on the total power consumption of the individual nodes. Finally, percentage of energy conserved in this work and previous work is calculated. Theoretical analysis is performed for both static and mobile events.

**TABLE 5.1 TIME SPENT BY EACH NODE IN SENSE STATE**

| NODES | TRANSMISSION TIME IN MINUTE/SECONDS |
|---|---|
| Node 0 | 49.9273999999 ms |
| Node 1 | 49.9273999999 ms |
| Node 3 | 49.7204899999 ms |
| Node 4 | 49.8765799999 ms |
| Node 5 | 50.0 ms |
| Node 6 | 50.0 ms |
| Node 7 | 50.0 ms |
| Node 8 | 49.9165100000 ms |
| Node 0 | 49.8765799999 ms |

### TABLE 5.2 POWER CONSUMED BY EACH NODE IN SENSE STATE

| NODES | TRANSMISSION TIME IN MINUTE/WAIT |
|---|---|
| Node 0 | 49.9273999999 mW |
| Node 1 | 49.9273999999 mW |
| Node 3 | 49.7204899999 mW |
| Node 4 | 49.8765799999 mW |
| Node 5 | 50.0 mW |
| Node 6 | 50.0 mW |
| Node 7 | 50.0 mW |
| Node 8 | 49.9165100000 mW |
| Node 0 | 49.8765799999 mW |

### TABLE 5.3 POWER CONSUMED BY EACH NODE IN TRANSMIT STATE

| NODES | TRANSMISSION TIME IN MINUTE/WAIT |
|---|---|
| Node 0 | 0.0725999999 mW |
| Node 1 | 0.0725999999 mW |
| Node 3 | 0.2795099999 mW |
| Node 4 | 0.12342 Mw |
| Node 5 | 0 Mw |
| Node 6 | 0 mW |
| Node 7 | 0 Mw |
| Node 8 | 0 mW |
| Node 0 | 0.12342 mW |

### TABLE 5.4 POWER CONSUMED BY EACH NODE IN TRANSMIT STATE

| NODES | TRANSMISSION TIME IN MINUTE/WAIT |
|---|---|
| Node 0 | 0.0725999999 mW |
| Node 1 | 0.0725999999 mW |
| Node 3 | 0.2795099999 mW |
| Node 4 | 0.12342 Mw |
| Node 5 | 0 Mw |
| Node 6 | 0 mW |
| Node 7 | 0 Mw |
| Node 8 | 0 mW |

| | |
|---|---|
| Node 0 | 0.12342 mW |

### TABLE 5.5 TOTAL POWER CONSUMPTION BT THE ENTIRE PROCESS

| NODES | VALUES |
|---|---|
| Total power spent in the sense state | 499.244959999 mW |
| Total power spent in the transmit state | 0.67154999999 mW |
| Total power consumed | 499.916510002 mW |
| Percentage of Energy conserved | 50.0083489995 % |
| Percentage of Energy conserved | 33.5%(Previous one) |

## VI. CONCLUSION

Preserving coverage and connectivity in a sensor network has been a problem that has been addressed in the past. However, most of the approaches have assumed the aid of either GPS, or have proposed the use of directional antennas or localization infrastructure. Given that sensors are envisioned to be light-weight energy constrained devices, it may not be desirable to equip them with such additions. This work shows that the power saved in each node outperforms the power saved in any other previously known protocols and this work also shows that it is possible to minimize about 51% of the power and maintain 100% coverage and connectivity. Further, simulation study also proves that it is possible to increase the life time of each sensor network by increasing the number of sensor nodes.

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