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An Efficient Opportunistic Routing Protocol in Underwater Communication

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Abstract

For many years, opportunistic networks have gain fame in research and industry as a natural evolution of mobile ad hoc networks (MANETs). It is a more common concept of delay tolerant networks, which opens a thrilling path for connecting nodes opportunistically and communicates wirelessly and at the similar time expands the possibilities for real-life application problems. Presented ad hoc routing protocols, although robust to quickly changing network topology, suppose the being there of a connected path from source to destination. In this proposed system, we make a base station (BS1) on the upper layer of water. It is situated where signal strength is good. It will get the connection either by RSU (Road Side Unit) or by satellite. When it will get connected by RSU or satellite, sonar waves of base station amplifiers. Another base station (BS2) is situated under water at some distance from BS1 & gets radio waves by base station & its Sonar waves gets amplified.

Keywords: *DTN, RSU, routing protocols*

1. Introduction

Delay Tolerant Networks (DTNs), additionally known as intermittently connected Mobile networks, are wireless networks within which a completely connected path from source to destination is not likely to exist. But, sufficiently forwarding supported a restricted information of make contact with the behavior of nodes is challenging. but, such generally spare ad-hoc networks usually cannot hold the kind of along connectivity necessary by the typical Transport Control Protocol/Internet Protocol suite placed communications owing recurrent topography adjustment, disruptions, with network partitions induces the node association as a substitute, asynchronous message transient (as well assign to as store-carry-forward networking) have been optional to allow communication more than the space-time path so as to live in the above kind of networks .The opportunistic networking stems from the research area of mobile adhoc networks (MANET) but in mobile adhoc networks packets can only be transmitted when the links between nodes is established and packets can get lost when the network contacts is intermittent so packet delivery ratio is not good in MANET. To overcome this problem a **DTN** is used.DTN works when conventional network decline and the original routing protocol are needed. It implements a message in thin portable adhoc networks

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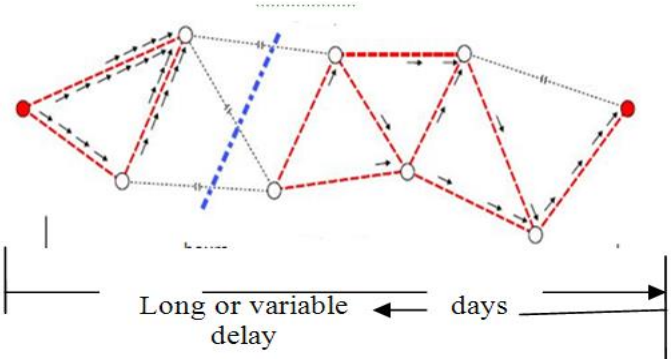

Figure 1. Delay Tolerant Network

when there is no path between source to destination [1]. DTN generally cannot support the TCP/IP (transfer control protocol/internet protocol) based communication due to the problem of frequent topology changes. Then we come to opportunistic network, which is a subclass of DTN, the goal of this study is to add more realism to the simulations of DTN.The only difference between the MANET and Opportunistic network is the storage capacity of nodes.

1.1 TYPES OF OppNets

1) Sensor Networks:

Sensor network design depends on unrestrained or feebly-controlled connectivity to accomplish sense treatment more than time at small, value known an opportunistic antenna network method. This permit huge level sense energy to network at a lesser rate related to an everywhere stationary transportation of sensing devices, during this method, the sensor have been allows to a known relevance task, senses the aim environment in the ideal time frame and gather the information from it.

2) **Pocket Switched Networks (PSN):**

This type of network is made by the individual carrying movable devices (e.g., sensible phones, PDAs). In this situation, movable nodes (i.e., devices) are thinly dispersed and network are frequently, usually partitioned off attributable to physical division or node association. Many studies were carried out to capture traces of human mobility using Bluetooth or WI-Fi scanning (discussed within the next section). PSNs can alter social-based applications, making user-centric networks.

3) Vehicular Networks:

Since opportunistic networks make use of store-carry-and forward process based mostly hop by hop message exchange for the exchange of data. However, this relaxing needs an end to end path that leads to vehicular networks, which permit nodes to communicate in challenge networking environments. For active networks, such as mobile adhoc network and vehicular networks, the connection condition may alter very fast that may reduce the advantage from our optimization based on link error estimation. The Interplanetary network is a good example where connecting nodes spread across the solar system.

4) Amorphous Opportunistic Networks:

Amorphous Opportunistic Networks usually referred as superimpose networks so as to come interested in survival by the normal decentralized technique intended for

information distribution within insecure group. Systems like Semantic Opportunistic networks,Gnutella and Free net's status have boosted research in the applicable field, whereas social networking spread have provided a key used for the contented search network..

1.2 DTN Network Characteristics:

The DTN network design consists of computing systems taking part within the network referred to as"Nodes". Unidirectional Links connecting some nodes stable. These links might go Up & Down over time, due to mobility, failures (or) different events. When the link is up, the source node has a chance to send the data to the other end. In a DTN, this chance is termed "Contact". More than one contact may be available between a given combination of nodes.

BUNDLE PROTOCO (BP) /LICKLIDER TRANSMISSION PROTOCOL: The lay network way of the Delay Tolerant Network is described by the Bundle Protocol (BP). The bundle layer from an area a high that employs persistent storage to help battle network disruption, forming a store-and –forward superimpose network. A number of the key in the abilities of the Bundle Protocol contains [2]:

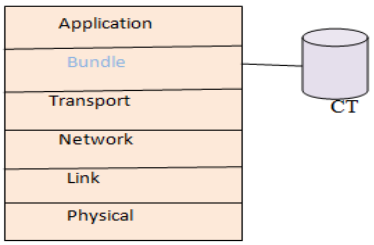

Figure 2. DTN Node

Where (CT) =Custody Transfer (persistent storage) point of retransmission.

Custody Transfer –the capability of a bundle node toward getting occupied accountability intended for a bundle arrives its last destination.

- The capability of implementations to handle with alternating property if needed.
- Ability of implementations to handle with long propagation delays if required.
- The ability to needs benefits of regular, anticipates, & opportunistic communication (during the adding toward constant communication).

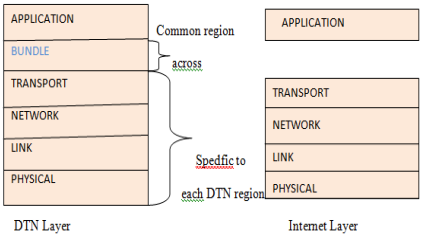

Figure 3. TCP/IP Layer and DTN Layer

1.3 Routing Strategies In DTN:

Routing in DTN is mainly categorized into two types are as follows

a) Flooding Strategy:

Replicates messages to enough nodes consequently that the target nodes have to accept it. Uses knowledge concerning the network to choose the greatest pathway (short one) to the destination. Flooding Strategy are several replicas of the similar communication will be there bent with forwarded to a locate of nodes call transmit node, whichever lay up the message awaiting them preserve "contact" of the destination node. Flooding strategic benefit is the good quality possibility of bringing the source of the call by the destination, elevated probability of communication release to be successful, refusal universal or restricted information regarding the network.

i. Direct Contact

In this routing protocol simply permits to information to be able to forward in single hop[1]. Owing to its minimum appearance, it does not put away a large amount resources, and its use exactly single message communication while the source is able to direct contact through the destination.

ii. Two-Hop Relay

The message has two hops between the source and destination. But here be n nodes approximately the source and direct connect with the source, then there are n copies of the message should be develop from the source, and be transmitted to these nodes [1]

iii. Tree-Based Flooding

The technique of flooding is built on hierarchy structure [1]. Mutually decide how to create copies and establish the numeral of replicas a significant problem in that routing protocol.

iv. Epidemic Routing

In this routing, every node is able to become the mover, and it's established to messages be able to transmit by a far probability [3]. However, network resources are extreme a great deal.

v. Prioritized Epidemic Routing

The prioritized epidemic routing is to inflict a limited order in the message call bundle. Then, the preceding function of communication and delete be used, that need to be based on quadruple input that because the near rate to destination, the present rate beginning source, the termination time with the start time [4].

vi. Probabilistic Routing

In this schedule, while a communication reach on the node that does not contain an accessible call with another node, it has to be gathered in the shield awaiting the node concurrence by a dissimilar node. It simply gets to a node be able to obtain the message while its release probability goes beyond the threshold [5]

vii. RUNES (Reconfigurable Ubiquitous Networked Embedded Systems)

In this routing , present is a novel metric called"{m, n} hop" metric, wherever the rate of m resources how secure a communication be toward the source with the rate of n resources how secure a communication to the destination. But a communication is secure to the destination or secure toward the source, it wasn't possible toward its desire not be dropped.

b) Forwarding Strategy:

Or make utilize of network topology with the local/global information to locate the finest route to forward the message by the destination and there are is message replication, network metrics are required to estimate a particular path.Flooding strategic advantage is No replication -> fewer bandwidth and consumption, more rapidly while the finest way routing is used.

I. Location-Based Routing:

A distance function is used toward approximation the rate of delivering communication from one to the other. The advantage of that protocol is that it needs extremely small information regarding the network. However, it consists of two problems. The primary issue is the still if the space between two nodes is the least, present is no security that they will be during a place to correspond with each other. The second is to as a node's coordinate must typically alter.

II. Source Routing:

In source routing resources the source node is in indict of the entire of transmits and determine the pathway base of the network topology previous to the message get hooked on the node. This routing protocol will have a fine presentation simply while the source is secure near the destination.

III. Per-Hop Routing:

The forwarding decision is taken from the intermediary node while a message reach at the node. The node wholes the subsequents hop meant for the destination and place it in a line for that contest [6].

IV. Per-Contact Routing:

The routing table is computed every time a contract is available, as a substitute of computing the after that hop for a message. It establishes that every routing choice is complete with the mainly current information [6]. However, to establish the disk freedom is a large issue.

V. Hierarchical Routing:

Hierarchical routing is a many hop routing slightly, then a source routing, who benefit is to its extent used for local traffic figure and it does not require placement information. However,create contact with information is time-varying. For resolving this problem, we require a method to combine the time-varying information [6].

Comparison

The comparison results of the flooding familiesand forwarding families

Comparison For Forwarding Routing:

Location based routing is resource consumption and information usage is less. In location based routing there are no routing vector/table and there is bad scalability and the best part is that in location based routing loop free is available, but the effect is not good, in location based routing delivery ratio is minimized and the latency is normal. **Source routing** is resource consumption and information usage is normal. In the sources, routing there are no routing vector/table and there is bad scalability and the best part is that in the Source routing loop free is available. But the effect is not good, in the sources, routing, delivery ratio is low and latency long. **per-hop routing** is resource consumption is normal. In Per-hop routing there are no routing vector/table and there is bad scalability

and the best part is that in Per-hop routing lop free is available. But the effect is not good, in Per-hop delivery ratio is low and latency long. **Per-contact routing** is resource consumption and information usage is many. In Per-contact routing there is bad scalability and the loop free is not available bur the effectiveness is normal, delivery ratio is also normal and the latency is normal. **Hierarchical routing** is resource consumption and information usage is many. In Hierarchical routing vector/table is available and the scalability is good. And the best part is that the loop free is available, but the effectiveness is good and the delivery ratio is maximized and the latency is normal.

Comparison For Flooding Families:

In **direct contact** hop count is one, but the resources is low and the delivery ratio is minimized and the best part is that there is no routing vector table and the multipath ,effectiveness is also bad and the latency is long. **Two hop** count is two, but the resources is low and delivery ratio, and the best part is that there is no routing vector table but the multipath is available, effectiveness is also bad and the latency is long. **Tree based** flooding hop count is many, but the resources is high and the delivery ratio is low and the best part is that there is no routing vector table and the multipath is available, effectiveness is also bad and the latency is long. **Epedemic routing** hop count is many, but the resources is and delivery ratio is max and the best part is that there is routing vector table and the multipath is available, effectiveness is also normal and the latency is long. **Prioritized epidemic routing** hop count is many, but the resources is limited and the delivery ratio is normal and the best part is that there is routing vector table and the multipath is available, effectiveness is also good and the latency is normal.**Probabilistic routing** hop count is many, but the resources is limited and the delivery ratio is normal and the best part is that there is routing vector table and the multipath is not required,effectiveness is also good and the latency is normal. **RUNE** hop count is many, but the resources is limited and the delivery ratio is normal and the best part is that there is routing vector Table and the multipath is may be or may not be there, effectiveness is also good and the latency is long.

1.4. Routing Issues in DTNs:

The unusual properties of DTNs unavoidably hoist a figure of attractive problem [8, 9] which are summarized in this section.

a. Routing Objective

The majority necessary routing objective in DTNs is to maximize the probability of message delivery and minimize the message latency.

b. Resource Allocation

In general, the routing protocols should balance and target the maximize message release and minimize the resource utilization that is differing with one another.

c. Buffer Space

To deal with an extended time of disconnection, messages must be buffer for an extended amount of your time. The intermediate routes should need sufficient buffer space to lay up every the messages to be transmitted. Number of awaiting messages need extra accessible buffer space.

d. Reliability

For consistent delivery of knowledge in DTNs, some routing protocol must have various knowledge, which might guarantee and constant release of the knowledge.

e. Energy

In DTN nodes are moving from one place to another place so it's always lack of energy. Lots of power is inspired for sending, receiving & storing**.** thus, the energy-efficient intend of routing protocols be of the significance.

f. Security

Security is forever an significant problem, not simply during the DTNs however additionally together the standard networks. In DTN message can traverse from one node to another node before reaching to the destination. So security issue may occur at all nodes**.**

2. Literature Review

2.1 Problem with Routing While not DTN

In routing the link between the routers are a unit established, therefore the packet is often transferred from one node to the alternative node. Currently, if the link is not established, then Packets are born.

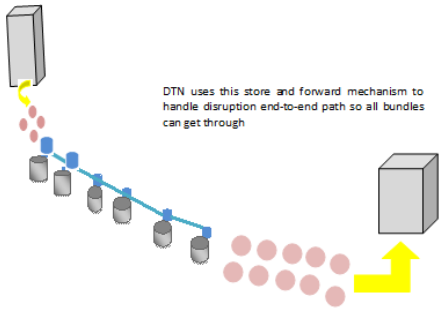

Figure 4. Shows the Problem during Routing

2.2Routing in DTN

In Delay Tolerant Network every node has a resource to store the package. Currently node can check if the link between node is recognized or not. If no, then the node can store the packet & forward the constant once the link is established

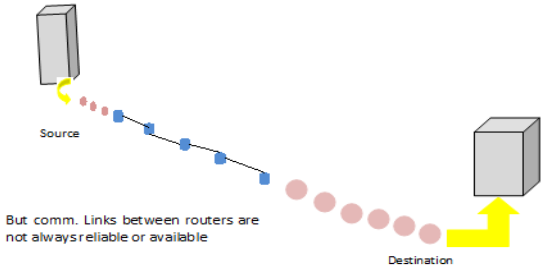

Figure 5. The DTN Scenario

2.3. Building Blocks for OppNets

a) Presence Awareness Service:

This service provides with data regarding alternative nodes and users that are presently active and in communication vary and prepared for active participation in communication.

b) Message Exchange Service:

A service that enables messages to be sent and received from node to node in communication varies. This service applies the core one-hop communication paradigm as introduced earlier.

c) Information Filtering Service:

In opportunistic network, there as additionally the threat of criminal activity in the network there should be a way to filter out information that might not be relevant to the actual user or not.

d) Information Distribution Service:

The knowledge distribution service offers different selections. A node can offer data it receives right now alternate nodes in communication vary.

e) Security Service:

In order to support knowledge or communication, integrity and authenticity, the protection service offers totally different operations on the data to make it safe from vulnerable changes during transformation from one hip to the other.

f) Identity Management Service:

This specifies, however a node appears within the system. The node will act beneath a name, or with appointed identities.

g) User Notification Service:

This instantly notifies nodes of incoming data which will need some kind of instant reaction. This facilitates the user regarding the data priority, whether it is low, medium or high according to the content and request of service.

2.4 Applications For DTN

i. Connectivity in Developing Areas

Dak Net [8] while an accomplishment of extremely little cost nonsynchronous connections, we have urbanized a store-and-forward wirelessly ad-hoc network intended for village connectivity well-known as Dak Net (www.daknet.net). The name derives as of the Hindi statement “dak” which means “post” or “post”. The Dak Net wirelessly network proceeds benefit of accessible connections by carrying transportation to allocate digital connectivity to out-of-the-way villages missing digital communications . DakNet combines objective means of moving with wirelessly information move in arranging to expand net connectivity provide through a middle uplink or the Hub (e.g., A cyber cafe, VSAT, or post office) to kiosk in a nearby village.while the information transfer provides by Dak Net are not concurrent, an important quantity of information has been able to be transferred at a long time ago. Since an effect it is attractive to observe to actually transport information from village to village by means of usually gives an advanced information throughput than further low-bandwidth technology, like phone modems. To employ short-distance means of communication, DakNet permits intended for little, small

cost less energy radio devices to be employed. DakNet [10] uses vehicles or data ferries to provide low-cost data delivery between rural villages. In each village, a kiosk is used by villagers to store messages and send data to visit data ferries, which then uploads the data they have together onto the Internet. A survey among health workers in low resource settings indicated that there is enough interest in dtn supported services to motivate further investigations [11].

ii. Zebra Net

Zebras [12], include custom sensors that track their associated patterns and locations. A device passed by a being or a mobile base station is used to gather the thought tracking information. As mobile base stations have limited communication range, zebras replace information with other zebras until they encounter a mobile base station. Given that zebras and a mobile station meeting arbitrarily, i.e., they may not meet each other for days or weeks, tracking data incurs significant delays before scientists are able to collect them. Moreover, as the movements of zebras are random, contracts are recognized occasionally and therefore there is no continuous path as of zebras to mobile base stations. In addition, Zebra Net also has storage space, bandwidth and energy constraints. Specifically, sensors on each zebra have a lifetime of only one month, are equipped with a 1MB flash Random Access Memory (RAM).

iii. Another wildlife example is SWIM[12]

Where a sensor network is used to monitor whales. SWIM combines two kinds of nodes: (i) sensors, and (ii) information station. The sensors are attached to whales, and the information stations are utilized to collect data from passing whales. Shared Wireless Information station Model (SWIM)is a project that aims toward gathering information regarding populations of whales and different marine mammals. Here also, radio frequency devices are implanted or attached to the animals.

iv. Disconnected areas

The Padjelanta National park in Laponia, Sweden is the home of the Saami population of semi-nomadic reindeer herders. The park lacks infrastructure and it is a UNESCO World Heritage website. Owing to this, large antenna towers or other invasive infrastructure cannot be installed [13]. The Saami Network Connectivity (SNC) project explored the thought of DTN for providing basic Internet services to the herders [14]. A pilot DTN demonstration was held in ore mines in Finland using ALIX.3D boards and mobile phones [15].

v. Urban areas

Numerous projects and applications have been designed for demonstrating the applicability of DTN in urban settings. Despite the wealthy property choices, there are scenarios where it is not cost-efficient (financially or power-wise) or not sufficient network coverage exists. In these cases, a DTN way can be preferable. User-provided Networks (UPN) will provide service to mobile users, whereas sharing a broadband connection. Although the Internet connection is “always-on”, connection sharing may be provided only in a “best-effort” approach, e.g., once the user-provider is away or does not use it heavily. Diesel internet is a test bed of 40 buses with DTN nodes that cover an area of 150 sq. Miles around the urban area of Amherst, MA, USA [16]. Examples include accessing Twitter and acting net search for a bus [17]. Bike Net is an example application for collecting information from bicycles routes and rides [18].

vi. Military Applications

Airborne Networks have a dynamic nature of topology that matches well with DTN [19]. Military services network embodies multiple and heterogeneous links. This is an ideal setting for a DTN way, since the bundle layer will act because the unifying layer on top of link-specific convergence layers and networking technologies.

vii. Village Networks

Village networks represent a really promising public application for DTNs, particularly in secluded areas lacking communication infrastructure [20]. Rural buses may be also used to provide net connectivity to isolated and remote villages [21]. Busses act here as relays or couriers, transmission and exchanging data via straightforward wireless transmission across the city's bus network. The transmission window here is narrow and limited by the time busses meet whereas in route across some information station.Another relevant example is the Wizzy Digital messenger service [22] that provides severed net access to students among other users in remote villages of South Africa.

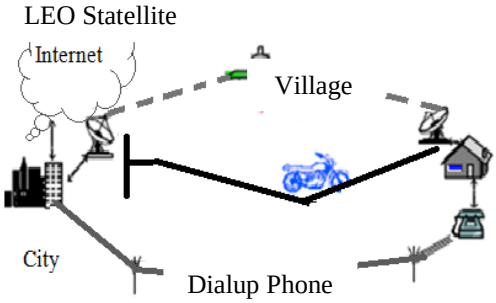

Figure 6. A Variety Of Connectivity Options Between A Remote Village And A City

2.5 Proposed Work

We make a base station (BS1) on the upper layer of water. It is situated where signal strength is good. It will get the connection either by RSU (Road Side Unit) or by satellite. When it will get connected by RSU or satellite, sonar waves of base station amplifiers. Another base station (BS2) is situated under water at some distance from BS1 & gets radio waves by base station & its Sonar waves gets amplified. BS1 help ships to communicate with each other. But here the problem is to establish communication between submarines. As we know, BS2 gets the connection by BS1 & its sonar waves get amplifies. This will help to establish a connection between submarines. So both base stations help establish connection & ships & submarines will easily communicate with each other. In this case if BS1 gets destroyed by any mean, BS2 will help to communicate submarines & submarines will help to establish communication between ships

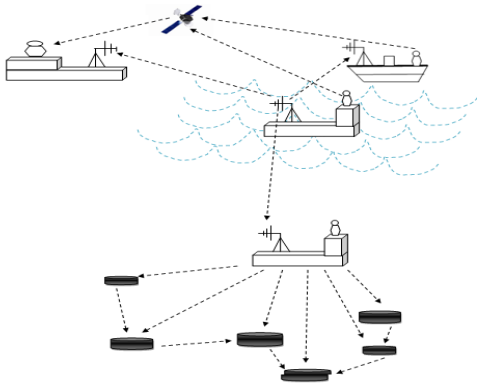

Figure 7. Submarine to Ship Communication

3. Conclusion

In this paper, we introduce a basic DTN technique, their application, type of DTN and DTN networks and DTN Routing strategy, we have also given a proposes a scheme for underwater communication using delay tolerant network .

We have also proposed , a scheme for underwater communication in which for connectivity two base stations, one is on the upper layer of water & second is under water which behave like an RSU for other underwater devices. Both base stations get amplified & helps ships & submarines to communicate with each other.

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