



A Review on MANET and DTN for Hybrid Network Architecture

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Abstract: The introduction of intelligent devices with short range wireless communication techniques has motivated the development of Mobile Ad hoc Networks (MANETs) during the last few years. However, traditional end-to-end based routing algorithms designed for MANETs are not much robust in the challenged networks suffering from frequent disturbance, less network density and limited device capability. Such challenge requires the combination use of network technologies. Since DTNs has been used for different applications with a large number of proposed routing algorithms. This paper describes the vital features of communication model aimed to enhance the protection of energy consumed assets against man-made attacks (terrorism) or natural disasters. The model is reviewed based on a hybrid network architecture, which combines the advantages of different wireless technologies, such as Delay Tolerant Networking and Mobile Ad-hoc Networks. The solution includes the definition of an extended routing protocol which is considered on account of the different networking technologies that already exist.

Keywords— MANET (Mobile Ad-hoc Network), DTN (Delay Tolerant Network), iMANETS (Internet Based Mobile Ad-hoc Networks), VANET (Vehicular Ad-hoc Networks), iVANETS (Intelligent Vehicular Ad-hoc Networks), AI (Artificial Intelligence).

I. INTRODUCTION

In Mobile Ad hoc Network, each device can freely move independently in any direction, and will therefore change its links to other devices after fixed interval of time. Each must forward traffic unrelated to its own use. An ad hoc network typically be defined as set of networks where all devices have equal status on a network and are free to create link with any other ad hoc network device in link range. This range can be short or long. One key problem in wireless ad hoc networks is fore seeing the variety of possible situation that can occur. As a result, modelling and simulation using extensive parameter sweeping and what if analysis becomes an extremely important paradigm for use in ad hoc networks. All these things should be done keeping in mind the factor of reduced power in WSN. These network technologies are currently facing many technical problems and unsolved issues of power and coverage some of the most crucial factors for sustainment of the networks are undertaken. Mobile computing is becoming the dominant computer usage in the Internet.

A Mobile Ad hoc Network (MANET) consists of mobile platforms, which are free to move about arbitrarily. Each of these individual component, herein simply referred to as “nodes”, logically consists of a router with multiple IP-addressable hosts and multiple wireless communications devices. A node generally consist of physically separate networked devices, or may be integrated into a single device such as a Laptop, Smart phones or Personal Computer. MANET could be classified under three categories:-

a. Internet Based Mobile Ad-hoc Networks (iMANETS) are ad-hoc networks that connect the mobile nodes to the fixed internet gateway nodes. Internet-based mobile ad hoc networking is an emerging technology that supports self-organizing, mobile networking environment. The technology enables an autonomous system of mobile nodes, which can operate in isolation or be connected to the greater Internet.

- b. Vehicular Ad-hoc Networks (VANET) is network technology that is applied for communication among vehicles and roadside equipments. VANET is a form of Mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles and nearby fixed equipment, usually described as roadside equipment. Each vehicle equipped with VANET device will be a node in the Ad-Hoc network and can receive/transmit and relay others messages through the wireless network.
- c. Intelligent Vehicular Ad-hoc Networks (In VANETS) are types of AI techniques that help vehicles during collisions, accidents & etc. In VANET is an Intelligent Vehicular Ad Hoc Networking uses Wi-Fi IEEE 802.11 and Wi-MAX IEEE 802.16 for easy and effective communication between vehicles with dynamic mobility.

A DTN is an approach to computer network architecture that seeks to address the technical issues in heterogeneous networks that may lack continuous network connectivity. A delay-tolerant network is a network designed to operate effectively over extreme distances such as those encountered in space communications or on an interplanetary scale. In such an environment, long latency sometimes measured in hours or days is inevitable.

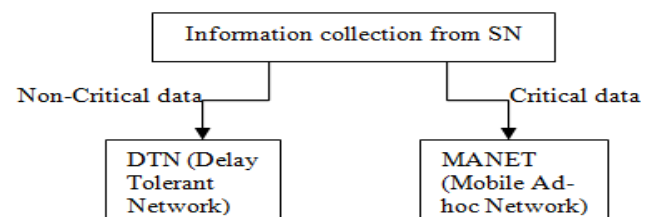


Figure 1: Hybrid of DTN and MANET

In this context, the objective of the DTN/MANET Routing Study for energy critical infrastructure protection project (DMRS) [2] is to study and propose an innovative

communication model as network architecture, capable of improving the security and the resilience of critical assets against man-made (terrorism) or natural disasters. More specifically, the paper review to do research on how DTN (Delay/Disruption Tolerant Networking) and MANET (Mobile Ad-hoc Networks) technologies can be combined into a hybrid architecture where implementing robust communications systems. It can be done by switching between DTN and MANET

II. RELATED WORK

In this paper, the author [1] focus on the terminal-to-terminal communication technology, which enables communication without requiring any fixed infrastructure. The typical networks that fit this paradigm are Mobile Ad-hoc Network (MANET) and Delay and Disruption Tolerant Network (DTN). In these networks, the users can transmit messages by relaying the messages through other mobile terminals such as Smartphone, laptop, or tablet PC. Since transmission methods of MANET and DTN are different, their performances depend on communication environment such as their mobility and overall terminal density. MANET is suitable for the environment where the terminals are static and are in dense area, but DTN is more suitable for the environment where user terminals have high mobility and are mostly isolated.

Conclusion: They propose a method, which switches the terminal's communication mode between MANET and DTN, to take advantage of different network characteristic and avoid wasting of network resource. Additionally, we implemented this algorithm in actual smart phones. Through the experiment using these smart phones, they have confirmed that the algorithm functions correctly.

In this paper, author [2] explained that Delay Tolerant Network (DTN) is evolved from Mobile Ad-hoc Network, MANET. It is sparse and intermittently connected mobile ad hoc network where reliable communication and end-to-end connectivity is not available for message transmission. The end to end connectivity is not ensured in Delay Tolerant Network. Only high latency applications are used in DTN. Latency may be in hours or days. The store and forward approach helps to increase message delivery probability in DTN irrespective of time taken to delivered message over normal MANET. In DTN, the two or more nodes can exchange message when they move in transmission range of each other. Routing issue is very important due to limited resources for message storage and forwarding. This Routing issue is considered by many researchers which results in many routing protocol based on Flooding and Forwarding Approach.

- a. Conclusion: In this paper they try to summarize the routing protocols till date which are available in literature. They also try to compare the entire routing protocol. This paper gives right direction to researchers to proceed for designing a new routing protocol for Delay Tolerant Network.

In this paper, author [3] explained that the introduction of intelligent devices with short range wireless communication techniques has motivated the development of Mobile Ad hoc Networks (MANETs) during the last few years. However, traditional end-to-end based routing algorithms designed for MANETs are not much robust in the challenged networks suffering from frequent disruption,

sparse network density and limited device capability. Such challenged networks, also known as Intermittently Connected Networks (ICNs) adopt the Store-Carry-Forward (SCF) behaviour arising from the mobility of mobile nodes for message relaying.

The term ICNs as Delay/Disruption Tolerant Networks (DTNs) for the purpose of generalization, since DTNs have been envisioned for different applications with a large number of proposed routing algorithms. Motivated by the great interest from the research community, we firstly review the existing unicasting issue of DTNs because of its extensive research stage. Then, we also address multicasting and any casting issues in DTNs considering their perspectives.

- b. Conclusion: A detail survey based on our taxonomy over the period from 2006 to 2010 is not only provided but also a comparison is given. We further identify the remaining challenges and open issues followed by an evaluation framework proposed for routing in DTNs.

In this paper, author [4] propose HYMAD, a Hybrid DTN- MANET routing protocol which uses DTN between disjoint groups of nodes while using MANET routing within these groups. HYMAD is fully decentralized and only makes use of topological information exchanges between the nodes. We evaluate the scheme in simulation by replaying real life traces which exhibit this highly dynamic connectivity. The results show that HYMAD outperforms the multi-copy Spray-and-Wait DTN routing protocol it extends, both in terms of delivery ratio and delay, for any number of message copies.

- c. Conclusion: A Hybrid DTN-MANET approach promising venue for the delivery of elastic data in mobile ad-hoc networks as it retains the resilience of a pure DTN protocol while significantly improving performance.

III. HYBRID OF DTN AND MANETS

To solve most of these problems, multi-hop wireless technologies (e.g., mesh and ad-hoc networks and Delay Tolerant Network routing protocols) have been investigated. Such approach allows communication to happen by sending/retrieving information through different hops (e.g., end-users devices, access points and vehicles), which may mitigate some of the problems posed by physical obstructions and coverage problems due to node mobility (which may move out of range of their access point). However, it is imperative to say that, since information is relayed among nodes and these nodes can be highly dynamic, communication will not experience delay.

A. Manet:

Stands for "Mobile Ad Hoc Network." A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. The purpose of the MANET working group is to standardize IP routing protocol functionality suitable for wireless routing application within

both static and dynamic topologies with increased dynamics due to no demotion or other factors.

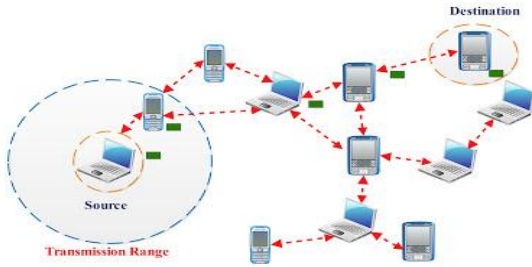


Figure 2: how data is send from transmitter to receiver in MANET

Vulnerability is a weakness in security system [2]. A particular system may be vulnerable to unauthorized data access because the system does not verify a user’s identity before allowing data ease to access. MANET is more vulnerable than wired network. Some of the vulnerabilities are as follows:-

- a. Lack of centralized management
- b. Resource availability
- c. Scalability
- d. Cooperativeness
- e. Dynamic configuration
- f. Limited Power Supply

There are different types of attacker present in MANETs, which tries to decrease the performance of network by consuming more battery.

There are several kinds of routing protocols for wireless ad hoc network .These routing protocols are categorized as reactive or proactive routing protocols.

- a) **Proactive MANET:** Proactive MANET protocols keep on updating network topology information constantly ensuring that it’s available to all the nodes. These protocols reduce network latency and increases data overhead by updating routing information constantly. In this type of routing protocol, each node in a network maintains one or more routing tables which are updated regularly. Each node sends a broadcast message to all the nodes in the network if there is a change in the network Configuration.[5] However, it incurs additional overhead cost due to maintaining up-to-date information and as a result; throughput of the network may be affected but it provides the actual information to the availability of the network. Distance vector (DV) protocol, Destination Sequenced Distance Vector (DSDV) protocol, Wireless Routing protocol Fisheye State Routing (FSR) protocol are the examples of Proactive protocols.
- b) **Reactive Protocols:** Reactive protocols seek to set up connection on-demand i.e. if there is requirement. If a node wants to start a communication with a node to which it has no connection, the routing protocol will try to establish such a connection between them.
- c) **Hybrid MANET routing protocols:** Hybrid protocols are the integration of both reactive and proactive MANET protocols. Hybrid protocols combines the advantages of both reactive and proactive protocols resulting in better performance protocols that could adjust dynamically to different network conditions.

A proactive approach to MANET routing seeks to maintain a constantly updated topology understanding. The whole network should, in theory, be known to all nodes.

This results in a constant overhead of routing traffic, but no initial delay in communication.

B. DTN:

The ability to transport/route, data from a source to a sink is a fundamental ability all communication networks must have. Delay and disruption-tolerant networks (DTNs) are characterized by their lack of connectivity, resulting in a lack of instant end-to-end paths.

- a. **Epidemic routing:** Epidemic routing is flooding-based in nature, as nodes continuously replicate and transmit messages to newly discovered contacts that do not already possess a copy of the message. In the simplest case, epidemic routing is flooding; however, more sophisticated techniques can be used to limit the number of message transfers [5]. Epidemic routing has its roots in ensuring distributed databases remain synchronized, and many of these techniques, such as rumour mongering, can be directly applied to routing.
- b. **Prophet Protocols:** The Probabilistic Routing Protocol using History of Encounters and Transitivity (Prophet) protocol uses an algorithm that attempts to exploit the non-randomness of real-world encounters by maintaining a set of probabilities for successful delivery to known destinations in the DTN (delivery predictabilities) and replicating messages during opportunistic encounters only if the Mule that does not have the message appears to have a better chance of delivering it.

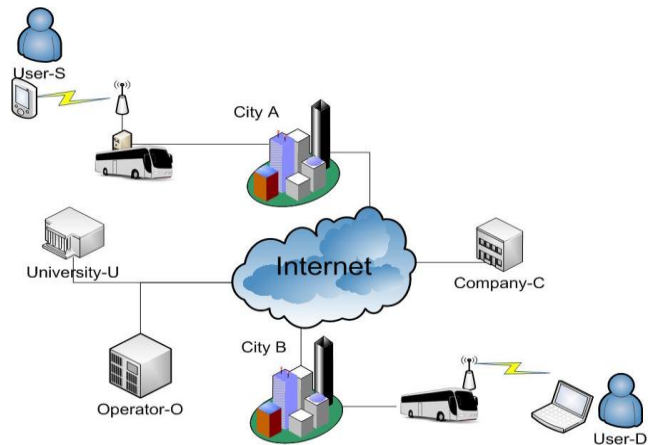


Figure 3: DTN in Multi network environment

C. Replication-based routing:

Replication-based protocols have recently obtained much attention in the scientific community, as they can allow for substantially better message delivery ratios than in forwarding-based protocols. These types of routing protocols allow for a message to be replicated; each of the replicas, as well as the original message itself, are generally referred to as message copies or message replicas. Possible issues with replication-based routing include:

- a. Network congestion in clustered areas,
- b. being wasteful with network resources (including
- c. bandwidth, storage, and energy), and
- d. network scalability.

IV. CONCLUSION

This paper is brief review of hybrid which can be made of two wireless technologies (MANET and DTN). Each

scheme has its own advantages and disadvantage. Comparison of DTN and MANET is being done in their routing protocols usage. This also discusses in brief about DTN and MANET. These networks enable communication between mobile terminals, such as phones and computers, without using fixed infrastructure. On the other hand, MANET and DTN have different transmission techniques and each network shows different performance depending on their scenario. Hence, we consider that it is more efficient to select the suitable communication mode for each terminal according to their scenario. We can develop the devices, which can switch its communication modes between MANET and DTN. Additionally, we implemented the mode selection algorithm, which switches its communication mode autonomously based on the device's acceleration, amount of remaining battery, and the number of neighboring terminals. They also use network resource effectively.

V. FUTURE SCOPE

In the future, we can work further on the implementation of hybrid algorithm. Our further investigations include experiments with high network load and different topology additionally; analysis of the hybrid algorithm is needed.

VI. REFERENCES

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