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Data Communication in Delay Tolerant Network – A Review

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***Abstract* - Data routing in a delay tolerant network is an area of concern in recent years and many researchers have proposed many techniques for routing. In delay tolerant sparse network number of nodes in the network is very fewer and probability of losing the data is very high. Many approaches have been proposed in recent past but most of them failed to perform significantly. In a network having sparse number of nodes, the decision to route the data through a significant node is an important issue in terms of delay, security of the data to name a few. In this work a review of various approaches used in delay tolerant network is proposed and their results are compared in order to build a logical conclusion about the significance of the routing of data.**

***Keywords* - Delay tolerant Network, Routing in DTN.**

I. Introduction

Delay and Disruption Tolerant Networks (DTNs) were initially motivated by the idea of deploying an Interplanetary Internet (IPN) for deep space communication. As a result, a framework for an IPN which aims to use an interplanetary backbone to connect internetworks in space was developed. Over time, a diverse set of other DTN applications for ‘‘extreme’’ environments on Earth have emerged including vehicular networks, emergency response and
military operations, surveillance, tracking and monitoring applications, and bridging the digital divide. In these applications, long delays are a consequence of the long distances and/or episodic connectivity which are characteristic of ‘‘extreme’’ environments. Delay-tolerant networks (DTNs) have attracted lots of attention in the past 10 years, and many related interesting applications have been experimented and tested, including mobile social networks based on human mobility, sensor networks for wildlife tracking and habitat monitoring, vehicular ad hoc networks for road safety and commercial applications, and deep-space interplanetary networks. In a DTN, most of the time there are no end-to-end paths from communication sources to destinations due to node mobility, wireless propagation effects, sparse node density, and other adverse factors. For this kind of network, traditional ad hoc routing protocols, which rely on end-to-end paths, fail to work.

The DTN architecture uses the so-called store-carry-and-forward paradigm, as opposed to the Internet’s store-and-forward, to deliver messages from source to destination. In store-carry-and-forward, nodes store incoming messages and forward them when transmission opportunities arise. Note that in traditional networks, nodes also store messages before forwarding them; however, the time scales at which data is stored locally while waiting to be forwarded are typically orders of magnitude smaller when compared to DTNs. Therefore, storage in store-carry-and-forward typically uses persistent storage which implies that DTN nodes need to be equipped accordingly. The DTN architecture, aims at providing implementations for reliable message delivery in intermittently-connected networks. It introduces the store–carry-and-forwarding paradigm under which messages may remain stored for relatively long periods of time in persistent storage at intermediate nodes while in transit from source to destination. The DTN architecture was designed to operate as an intermediate layer, called the bundle layer, between the application and the transport layers of the networks it interconnects. It provides services such as in-network data storage and retransmission, interoperable naming, authenticated forwarding, and coarse-grained classes of service. The DTN architecture also specifies the bundle protocol which controls the exchange of bundles, i.e., application- layer messages. The Bundle Protocol can operate either atop transport protocols (e.g., TCP, UDP, etc), or atop lower layer protocols (e.g., Bluetooth, Ethernet, etc). The term ‘‘bundle’’ was chosen to connote the self-sufficiency of the messages: application-layer messages are expected to contain sufficient metadata to enable processing by the recipient without negotiation, as if all relevant metadata query and response messages have been anticipated by the sender and ‘‘bundled’’ into a single application data unit. When operating atop the transport layer, the bundle protocol receives messages from the application.

II. Literature Review

Li, Yong, Pan Hui et al. [1] proposed Delay-tolerant network protocol testing and evaluation. TUNIE, a large-scale emulation test bed for DTN protocol evaluation based on network virtualization. Unlike the existing simulation tools and real-life test beds, which either cannot provide a realistic in this paper TUNIE architecture is presented which is capable of simulating reliable DTN environments and obtaining an accurate system performance evaluation.

Jain, Sushant, Kevin et al. [2] propose a framework for evaluating routing algorithms in such environments. Also several algorithms are studied and use simulations to compare their performance with respect to the amount of knowledge they require about network topology

Mehta, Namita et al. [3] Performance Evaluation of Efficient Routing Protocols in Delay Tolerant Network under Different Human Mobility Models has been presented. Delay and/or Disruption-Tolerant Networking (DTN) are a novel communication prototype that can span across multiple networks and deal with unpredicted conditions in the Internet model. Delay-tolerant networks (DTNs) are partitioned wireless ad hoc networks with intermittent connectivity. In this paper, it is studied and analyzed the performance of well known PROPHET and Spray and Wait routing protocol, under different human mobility models such as Truncated Levy Walk mobility model (TLW), Self-similar Least Action Walk (SLAW) and Random way point (RWP) model. The MATLAB simulator is used in order to analyze the performance of these routing protocols. Simulation results illustrate that Spray and Wait significantly outperforms the PROPHET on aspects of delivery ratio, average delay and communication overhead.

Silva, Aloizio P., Scott Burleigh et al. [4] this paper reviewed the state-of-the-art in DTN congestion control. This paper proposed a DTN congestion control taxonomy which is use to describe existing congestion control mechanisms and place them in context of one another. Also, the proposed taxonomy will help to map the DTN congestion control design space and put in perspective the many existing DTN congestion control techniques. Furthermore, exploration of the DTN design space will also help to identify important issues and questions that are yet to be addressed.

Liu, Yue, David R. Bild et al. [6] presented Performance and Energy Consumption Analysis of a Delay-Tolerant Network for Censorship-Resistant Communication. In this work, a flooding protocol is used and, adoption rate is indentified. It is found that the network delivery rate and delay are robust to denial-of service and censorship attacks eliminating more than half of the participants.

Lo, Shou-Chih et al. [7] presented Quota-control routing in delay-tolerant networks. Delay-tolerant networks (DTNs) are network environments that are subject to delays and disruptions. Traditional end-to-end routing protocols fail in such challenging network conditions because of intermittent connections and/or long delays. Research results have shown that per-hop forwarding of multiple copies of the same message to the destination can produce satisfactory routing performance in DTNs. Current methods rely on the fixed setting of a quota value to limit the number of message copies. This paper proposes a dynamic quota-control mechanism, allowing routing to operate effectively with different traffic loads. To remove useless message copies from the network, a low-cost probability-based method is also presented. The proposed routing framework is then extended to interest-based information dissemination, which is used to efficiently disseminate an event message to all interested users.

III. CONCLUSION

Delay tolerant sparse network is a network having very fewer nodes available for communication. There are many approaches proposed in the recent past but still routing is a major concern in these types of networks. Many approaches used for routing in the Delay Tolerant Network have been verified and used. In one of the approach a taxonomy for the delay tolerant network is proposed and the network taxonomy is tested under certain different conditions. In another approach a network model based on the flooding of data is proposed and various performance parameters on the basis of denial of service are proposed and implemented.

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