



Disturbance Forbearance Network

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Abstract: Disturbance forbearance Network, well known as Disruption Tolerant Network (DTN) has wide scope today in internet world because of its ability to transfer the message even when the connection is broken down. DTN uses simple store and forward concept, which can be also called as opportunistic network since the sender node may not possess direct contact with the receiver. DTNs have several applications in various areas like interplanetary networking, military networking, etc. In this paper we discuss about few well known applications of disturbance forbearance network, few well known techniques like ferrying, multi-hopping, delivery probability. Also we study about the DTN protocols like bundle protocol and convergence protocols along with few approaches proposed earlier for DTN.

Keyword: Disruption Tolerant Network, Store and Forward, Opportunistic network, protocols.

I. INTRODUCTION

The disturbance forbearance network which is well known as Disruption tolerant networks (DTNs) has got vast scope in today's real world scenario. DTN is the idea of ancient postal system, where the data was stored and forwarded, similarly today's mail system works but it is not node to node relay rather star relay. DTN It is said to be opportunistic network because the sender and receiver may not contact at the same time. When there is no sustainability of the network infrastructure, opportunistic network can be a solution, where delay is less or nothing. A store and forward concept (Fig. 2) is feasible for implementation. the user can store the data in a node ,whenever the network or service connectivity is broken, data can be used or fetched by the other end-user, there is always scope for disturbance free and low delay network especially provide service coverage where Internet is not available and also in the extreme environmental factors, underdeveloped nations ,emergency network setup .Interconnection links are short in time ,may suffer from high error rate due to which disturbance tolerant networks are necessary. DTNs are built on existing network that is overlay special purpose network.

There is a great need for disturbance forbearance network, because of discontinuous connectivity that is if communication end to end path is broken, communication will not be possible by TCP/IP protocol, network suffers connectivity problem. Also long delay can occur due to many conversations and acknowledgments; asymmetric data rate is present if error occurs also due to multi hops high error rate occurs in normal network.

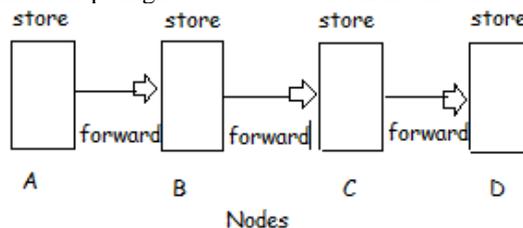


Fig.1 Store and Forward communication model.

II. APPLICATION OF DISTURBANCE FORBEARANCE NETWORK

There are several applications which can rely on disturbance forbearance network in real world. Applications are widespread in various areas like space and military communication, research, etc .some common applications include civilian network that connects wireless devices that could be remote environment or animal out spot, military or defense network or outer space network. International space station communication, interplanetary communication, wireless ad hoc communication, shipment vehicle tracking ,rescue communication, reservations, agricultural crop monitoring ,underground mine communication, ,disaster recovery and security communication ,search rescue communication, smart transportation, airport traffic ,unplanned aerial vehicle communication, personal monitoring, an seismological events ,geographical studies, engineering research are also well known applications.

III. PROTOCOLS OF DISTURBANCE FORBEARANCE NETWORK

Due to the store and forward concept usage rather than the end to end delivery, Disruption tolerant network or disturbance forbearance network differ in the protocols. Some of the important protocols used are Bundled protocol, Convergence layer protocols.

i. *Bundle protocol:*

Bundle protocol is a message oriented overlay set on top of various protocols; the underlying protocols can be TCP/IP or any other protocol like LTP. Bundle protocol agent stores and forwards whole bundle pieces between the nodes. Bundle protocol stores the message sent in a node, when actual contact or opportunity is there, the message is delivered to intended node. Bundle source and destinations are identified by ID. Indicator of bulk, normal or expedited is used to ensure quality of service, also message is either broken into pieces and sent or only partial part is delivered in case of urgency. Reliability is maintained in bundle transfer protocol since the node will have a timer set after transferring the message to neighbour node, waiting for the neighbour node acknowledgements, if neighbour does not acknowledge before the timer then retransmission takes place.

ii. *Convergence protocols*

Convergence protocols are also the types of protocols of DTNs. Licklider Transmission Protocol (LTP) is a kind of protocol where the operation is divided into two segments. In the first part, the part is sent to the receiver, the receiver should send the report back to sender later sender should acknowledge the receiver's report. Conversation of the first part is ended by the end of message, later the further second part transmission occurs without the acknowledgements. Time out is there to monitor transmissions. Saratoga protocol is another convergence protocol that does not depend on TCP instead works with UDP; Sarogata depends on negative acknowledgement status message instead of acknowledgment for every message. Status information about failure and success on selective transmission is done. An approach of HTTP protocol for DTNs is proposed, but it is complex to implement.

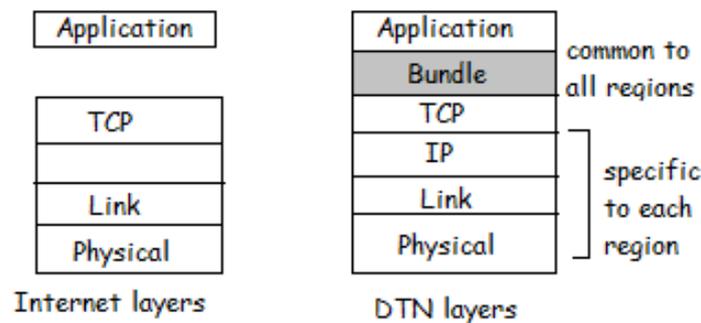


Fig. 2 DTN Bundle layer.

IV. TECHNIQUES USED IN DISTURBANCE FORBEARANCE NETWORK

There are several techniques used in DTNs, well known techniques are multi-hopping, Ferrying and delivery probability. Since the data has to pass from one node to another and kept at some storage node for the usage, Store and forward technique is implemented.

Due to some damages the network can be disconnected, in that time ferries play important role of transferring the data. Ferries will be in mobility which store the data and forward it, when they meet other nodes. In the node, buffer has to be maintained until it stores the data in to ferry, Hence buffer optimisation plays an important role.

When the link seems to be broken down, message has to somehow pass through, in such cases multiple hops could be used to transfer the message, the nodes involved in the transfer are the intermediate nodes which act both as host and router to transfer the message.

The nodes contact frequency and reliability by calculating and updating delivery probability just to avoid interruption in the transmission. The long contact duration links are preferred and given priority by which transmission reliability could be improved; this technique is known as delivery probability.

V. APPROACHES OF DISTURBANCE FORBEARANCE NETWORK

There are several approaches proposed for implementing disturbance forbearance network or DTNs, few are discussed below in brief.

A. MaxProp: Routing for vehicle based DTN

MaxProp is proposed by John Burgess, et al [5] to give an effective solution for disruptive network. It is based on prioritizing packets transferred and packets dropped which is indeed dependant on path likelihoods to nodes, according to old data and many mechanisms such as acknowledgements and a head start for new packets. MaxProp is proven to overcome drawbacks of other approaches hence came out to be an efficient routing protocol. MaxProp uses hop count in packets to measure network resource fairness, also acknowledges network wide. MaxProp also saves a list of previous intermediaries to prevent multiple propagation to the same node.

B. Supporting cooperative caching DTN

DTNs are likely to suffer from low node density, high mobility so the cooperative caching approach is proposed by Wei Gao, Arun Iyengar, et al [7] which supports cooperative caching that enables sharing of data among several nodes. A set of Network Central Locations are used which are accessible by other nodes. It is similar to publish/subscribe system where a broker delivers the data requested by the mobile user from the server using caching (where data is stored). Data access scheme to probabilistically coordinate multiple nodes for responding to user queries is proposed here.

C. Efficient Network Coded data transmission in DTN

To encourage low data transmission delay, Yunfeng Lin et al [6] proposed by which routing of batch of data packets are considered. E NCP protocol was proposed where network coding is done that reduces data transmissions, while slightly increases the transmission delays as compared to epidemic routing. When replication is used to minimize transmission delay a node should transmit a packet with the minimum number of replicas in the network, since it is the packet with the longest expected delay. Unfortunately one does not have precise global knowledge of which packet has the minimum number of replicas in opportunistic network. When network coding is used however a node can transmit a coded packet as a combination of all the packets in its buffer such that their information can be propagated simultaneously to the destination.

D. Disruption Tolerant military Network

This approach is proposed by Junbeom Hur, Kyungtae Kang [8] ,using which the network can operate in extreme environmental factors ,which would be military network ,the store and forward concept is shown in this approach. The sender encrypts the message specifying the access policy which should be possessed by receiver and sent encrypted data is stored in the node, when the storage node comes in contact with the receiver's range, forwarding happens . Storage node can be the military node.

VI. CONCLUSIONS

The disturbance forbearance network has wide scope since it works well even in disconnected internet to transfer the necessary messages. In this paper we study about DTNs or disturbance forbearance network, by knowing its wide range of applications. We also study few works which have already done such as protocols, well known techniques used in DTNs along with the few examples as approaches which give the efficient ways for designing, implementing and using disturbance forbearance network.

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