

TIMELY AND LOSSLESS DATA TRANSMISSION IN INTERRUPTION TOLERANT TECHNIQUES FOR WIRELESS NETWORKS

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ABSTRACT— Network area where the nodes are classified by accurate connectivity are referred as Disruption / Delay Tolerant Network (DTN). In DTNs, it is hard to maintain end-to-end connection because of small node density, random node mobility and need of global network information. It is possible to predict when the drop a line to of nodes will occur and how long it will last, using Semi-Markov Chain process. But this process has a problem with time complexity. So co-operative caching is introduced, in which data is cached at central nodes which are frequently contacted by others. Here, the data are transmission at set of Network Central Location (NCL) in 4G network. Lacking any loss of data and time delay the requested data is forwarded from source to destination.

Keywords: Disruption / Delay Tolerant Network, Semi-Markov Chain, co-operative caching, Network Central Location.

1. INTRODUCTION

The Internet has been a great success at interconnecting communication devices across the Earth. It has done this by using a homogeneous set of communication protocols, called the TCP/IP protocol suite. All devices on the hundreds of thousands of networks that make up the Internet use these protocols for routing data and insuring the reliability of message exchanges. Connectivity on the Internet relies primarily on wired links, including the wired telephone network, although wireless technologies such as satellite and short range mobile links are also an essential part of the network. Figure 1.1 shows the interconnection communication devices across the earth.

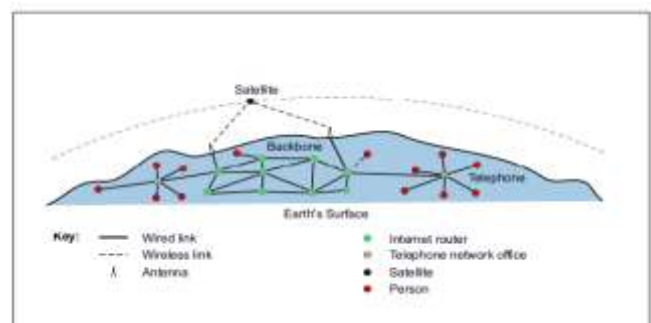


Figure 1.1: Interconnecting communication devices across the earth

Spanning two networks requires a protocol agent that can translate between network protocols and act as a buffer for mismatched network delays

1.1. LITRATURE SURVEY

Epidemic routing is the base for all data forwarding techniques in DTNs. Epidemic routing is a flooding based protocol relying upon the distribution of messages through the network to deliver information to their destination. It adopts a so-called “store-carry-forward” paradigm - a node receiving a packet buffers and carries that packet as it moves, passing the packet on to new nodes that it encounters. Epidemic routing is able to achieve minimum delivery delay at the expense of increased use of resources such as buffer space, bandwidth, and transmission power. To overcome the problem of increased resource utilization other techniques were proposed which are discussed in the following subsections.

1.2 USER CENTRIC DATA DISSEMINATION

Gao et al have proposed a user centric data dissemination technique. When data are disseminated based on network centric approach data are forwarded to all the nodes and hence network resources are wasted. Also, in network centric approach relays are selected based on the scope of network information maintained at individual node forcing every node to maintain network information. To overcome these drawbacks of network centric approach, the data is disseminated based on user centric approach using the technique called social-based data forwarding.

The major difficulty of user-centric data dissemination in DTNs is that the interesters of a data item are generally unknown a priori at the data source, because it is difficult for the data source to have knowledge about the interests of other nodes in the network. Such uncertainty of data recipients is different from unicast or multicast in which the destinations are fixed and pre-known, and makes relay selection for user-centric data dissemination challenging.

The idea to overcome the aforementioned difficulty is to let a node estimate the interest of another node in a data item as probability, based on which the user-centric data dissemination from the social network perspective. Node centrality in DTNs has been exploited to consider the social contact patterns and interests of mobile nodes simultaneously for effective relay selection. While centrality in Social Network Analysis (SNA) generally represents the capability of a node facilitating the social communication among other nodes, we expand the centrality concept to analytically represent the capability of a node to forward data to its interesters. Here the data is forwarded to only interested nodes by splitting data dissemination into two parts:

- i) **Uncontrollable part**, where the Data is disseminated among interesters automatically without help of additional relays.
- ii) **Controllable part**, where the relays are intentionally selected among the non-interested nodes.

1.3 EVOLVING WIRELESS NETWORKS OUTSIDE THE INTERNET

Communication outside of the Internet (Figure 1.2)—where power-limited wireless communications are developing—is done on independent networks, each supporting specialized communication protocols. Most of these networks are mutually incompatible—each is good at passing messages within its network, but not able to exchange messages between networks. The nodes of each

network communicate among themselves using the same set of communication protocols. Each network also has communication characteristics that are relatively homogeneous—for example, link delay, link connectivity, data-rate asymmetry, error rates, addressing and reliability mechanisms, quality-of-service provisions, and trust boundaries. Unlike the Internet, the evolving wireless networks experience long and variable delays, arbitrarily long periods of link disconnection, high error rates, and large bidirectional data-rate asymmetries.

Examples of wireless networks outside of the Internet include:

- Civilian networks on Earth that connect mobile wireless devices, such as networks for intelligent highways, and remote environmental and animal movement outposts.
- Wireless military battlefield networks connecting troops, aircraft, satellites, and sensors on land and in water.
- Outer-space networks, such as the InterPlaNetary (IPN) Internet project,

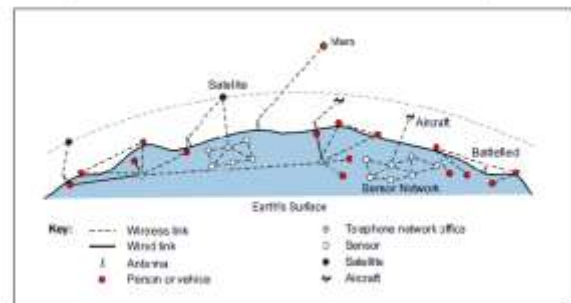


Figure 1.2: Wireless communication outside the Internet

2.SYSTEM DESIGN

In a wireless network, data can be transferred between the nodes when they are within the communications ranges. To deliver data to the requester in DTNs without any loss and time delay a technique is proposed in this chapter based on co-operative caching. In this technique the requester/destination sends query about requesting data to the network, then the data source responds to the query by sending the requested data. Here the data are intentionally cached at an optimal set of NCLs (Network Central Location). The number of nodes used for caching is optimized such that the cost for caching data in multiple nodes is not very high. If a central node's buffer is full, then the data is cached by another node near the central node. A new central node is selected when the central node fails.

In normal network each node has four parameters (i) wireless (ii) propagation or 2-ray ground model (iii) queue model or drop tail or pre queue (iv) MAC protocol. For 4G networks, in above four parameters (iii) and (iv) parameter must be replaced. Here MAC protocol is replaced by LTE MAC in MAC protocol. This protocol runs based on OFDMA orthogonal frequency division multiple accesses. The data rate will be based on this frequency. Based on data rate bandwidth is efficient. To get this efficient bandwidth QAM is used. This QAM works well compared to BPSK and QPSK. By caching data at central nodes which are frequently contacted by others, queries in the future can be responded with less delay, and the average access performance (access ratio and access delay) of the whole network may be improved efficiently.

3. FLOW DIAGRAM

The figure 3.1 shows the flow diagram of the proposed system. It shows the step by step process of proposed work. To deliver data to the requester in DTNs without any loss and time delay a technique is proposed in this section based on co-operative caching. In this technique the requester / destination sends query about requesting data to the network, then the data source responds to the query by sending the requested data. Here, the data are intentionally cached at an optimal set of NCLs (Network Central Location).

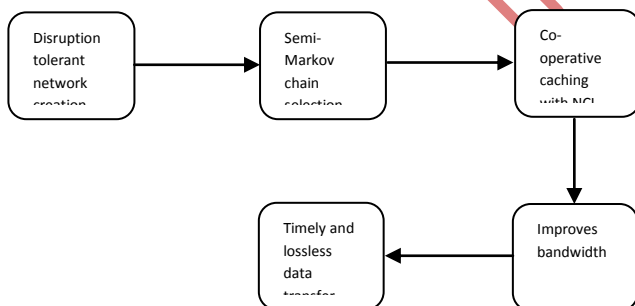


FIGURE 1.3: Flow diagram of the proposed system

3.1 THE CONCEPT OF A DELAY- AND DISRUPTION-TOLERANT NETWORK (DTN)

A DTN is a network of smaller networks. It is an overlay on top of special-purpose networks, including the Internet. DTNs support interoperability of other networks by accommodating long disruptions and delays

between and within those networks, and by translating between the communication protocols of those networks. In providing these functions, DTNs accommodate the mobility and limited power of evolving wireless communication devices. DTNs were originally developed for interplanetary use, where the speed of light can seem slow and delay-tolerance is the greatest need. However, DTNs may have far more diverse applications on Earth, where disruption-tolerance is the greatest need. The potential Earth applications span a broad range of commercial, scientific, military, and public-service applications. DTNs can accommodate many kinds of wireless technologies, including radio frequency (RF), ultra-wide band (UWB), free-space optical, and acoustic (sonar or ultrasonic) technologies. Figure 1.3 shows the communication between DTN Nodes.

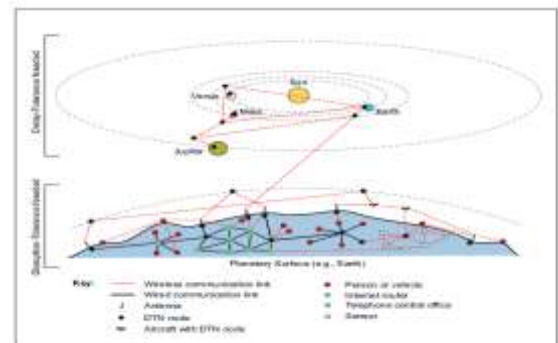


Figure 1.4: Communication between DTN Nodes

3.2 INTERNET—PACKET-SWITCHING

Communication on the Internet is based on packet-switching. Packets are pieces of a complete block of user data (e.g., pieces of an email message or a web page) that travel independently from source to destination through a network of links connected by routers. Routers switch the direction in which the packets move. The source, destination, and routers are collectively called nodes. Each packet that makes up a message can take a different path through the network of routers. If one link is disconnected, routers redirect the packets to use an alternate link. Packets contain both application-program user data (the payload part) and a header (the control part). The header contains a destination address and other information that determines how the packet is switched from one router to another. The packets in a given message may arrive out of order, but the destination's transport mechanism reassembles them in correct order.

Figure 1.4 shows the communication based on packet-switching

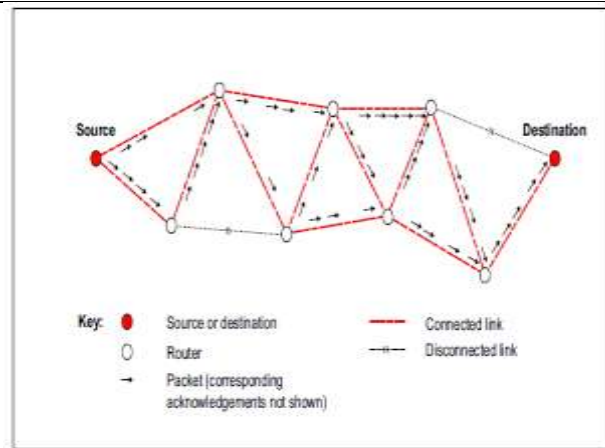


Figure 1.5: communication based on packet-switching

OPPORTUNISTIC CONTACTS

Network nodes may need to communicate during opportunistic contacts (Figure 1.10), in which a sender and receiver make contact at an unscheduled time. Moving people, vehicles, aircraft, or satellites may make contact and exchange information when they happen to be within line-of-sight and close enough to communicate using their available (often limited) power. All of us use opportunistic contacts for communication: when we happen, by chance, to meet certain people with whom we wish to talk, we begin a conversation.

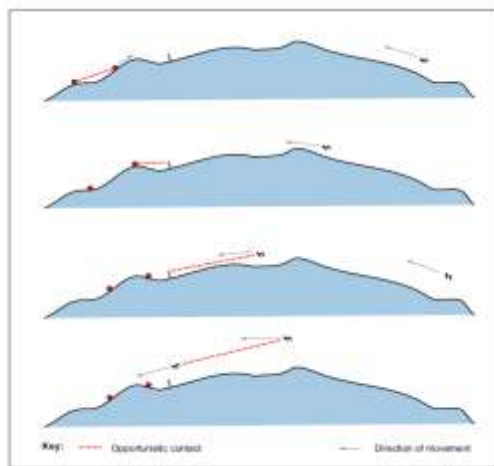


Figure 1.6: Opportunistic contacts

SCHEDULED CONTACTS

In space, almost everything is in motion and speed-of-light delays are significant (Tens of minutes within our solar system). Potentially communicating nodes move along predictable orbital paths, so they can

predict or receive time schedules of their future positions and thereby arrange their future communication sessions.

Scheduled contacts may involve message-sending between nodes that are not in direct contact, as shown in the Figure 1.11. They may also involve storing information until it can be forwarded, or until the receiving application can catch up with the sender's data rate. Scheduled contacts require time-synchronization throughout the DTN.

4. MULTICASTING IN DTNs

Centrality-based heuristic for Single Data Multicasting (SDM) has been developed. This technique is based on the local knowledge of the data source. The different nodes presented here have heterogeneity in their contact patterns, and such heterogeneity validates the use of Social Network Analysis (SNA) for data forwarding in DTNs. There are two key concepts in SNA methods:

TABLE: 1.1 Record of social forwarding path table

D	Hops $\{N_1, \dots, N_{K-1}, D\}$	Edge weights $\{\lambda_1, \dots, \lambda_K\}$
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- (i) **Communities**, which are naturally formed according to people's social relations. Social communities are derived from the "small-world" phenomenon, which is first investigated by Milgram's experiment, and is later formalized as a random graph problem.
- (ii) **Centrality**, which shows that some nodes in a community are the common acquaintances of other nodes and act as communication hubs. Since social relations among mobile users are more likely to be long-term characteristics and less volatile than node mobility, social-based forwarding schemes outperform traditional approaches based on oblivious heuristics or mobility-based predictions. The aforementioned work focuses on forwarding data to a single destination.

The relays are selected among the contacted neighbors of the data source based on their centrality, to ensure that the required delivery ratio can be achieved within the time constraint. The minimum number of relays is selected to satisfy the required delivery ratio within time constraint. When the data source selects

relays, some contacted neighbors of the data source with higher centrality may not be in contact with the data source. To select relays among these nodes, we should also consider the time needed for them to contact the data source.

Multicasting in DTNs is introduced, in which even multiple data can be forwarded based on the technique called weighted social network model. In this model the edges in the network contact graph are modeled as Poisson processes with pairwise node contact rates as the parameters. Based on this model, node centrality and social community structures are exploited for relay selections under the unified knapsack formulation. A community-based approach to solve the MDM Problem to which localized heuristic is not applicable due to the node buffer constraints and the subsequent requirement of destination awareness.

Each node maintains the “best” social forwarding path with the largest path weight to all the other nodes within the same community. To do this, we assume that each node in the network belongs to at least one social community. An efficient community detection mechanism is therefore needed. The k -clique community detection mechanism has been used, because they are able to detect overlapping communities. A social community can be defined differently by the community detection mechanisms. Each node maintains a social forwarding path table for all the other nodes within the same community, and the record format for the path to a node D is shown in Table. If a node belongs to multiple communities, a separate table is maintained for each community. Initially, each node only has the information about its contacted neighbors. When a node A contacts another node B , they exchange and update their social forwarding path tables.

4.1 DATA TRANSMISSION BASED ON COMMUNAL CALL PATTERN

The capability for a mobile node to forward data to the destination is indicated by the data forwarding metric. Some schemes propose data forwarding metrics by exploiting the stochastic node contact process based on experimental and theoretical analysis. Some others propose metrics based on the prediction of node mobility and its probability of contacting the destination. However, the performance of these schemes is limited due to the randomness of human mobility and thus the low prediction accuracy.

The Best relay choices could not be achieved within short period due to heterogeneity of transient node

contact characteristics. Gao et al. have suggested that this can be done by exploiting the transient social contact pattern. Social contact pattern has 2 perspectives.

- i. **Centrality** - this indicates that some nodes are the common acquaintances of other nodes and thus have better capabilities of contacting others.
- ii. **Community** – this indicates that people are naturally organized into groups according to their social relations.

Node centrality is evaluated at the global scope which includes all the nodes in the network, to ensure that data is carried and forwarded by relays with higher capability of contacting other nodes. Then, when a relay contacts a node within the same community of the destination, data is forwarded to that community. Afterward, node centrality is evaluated within the local community scope, and data is forwarded directly to the destination.

In both stages, most of the current social-aware data forwarding schemes evaluate the centrality of mobile nodes based on their cumulative social contact patterns. We observe that the transient social contact patterns of mobile nodes during short time periods in DTNs are usually different from their cumulative contact patterns. The relays selected by existing schemes, therefore, may not be the best choices for forwarding data with a short time constraint. Based on this observation, we improve the performance of data forwarding by exploiting the transient social contact patterns from the following perspectives.

- **Transient contact distribution**, which may be highly skewed during different time periods.
- **Transient connectivity (TC)**, which indicates that some nodes in DTNs may remain connected with each other during specific time periods to form transient connected subnets (TCS).
- **Transient community structure**, which indicates that a node may belong to different communities during specific time periods.

ALGORITHM: DataForwarding (i, j)

- 1 for each data d_k that node i carries do
- 2 If $j == \text{Dst}(d_k)$ then
- 3 Node i forward d_k to j

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4 else if Community (j) == Community (Dst( $d_x$ ))
    && Community (i)  $\neq$  Community (Dst( $d_x$ )) then
5 Node i forward  $d_x$  to j
6 else
7 Calculate the data transmission metrics  $m_i$  and  $m_j$ 
    for nodes i and j
8 if  $Q_i < M_j$  then
    9 Node i forward  $d_x$  to j
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4.2 EFFECTIVE ROUTING IN DTNS USING MAXPROP TECHNIQUE

Routing in Data transmissions areas transmission is effectively and It because peers have little information about the state of the partitioned network, DTN operations proceed roughly in three stages.

i) **Neighbor Discovery:** Peers must discover one another before a transfer opportunity can begin; they do not know when the next opportunity will begin.

ii) **Data Transfer:** When two peers meet, the amount of data they can transfer is limited. Peers do not know the duration of each opportunity.

iii) **Storage management:** As packets are received from a neighbor, each peer must manage its finite local buffer space by selecting packets to delete according to some algorithm. Messages that are destined for a receiving peer are passed up to the application layer and removed from the buffer

Each peer carries all messages until the next meeting occurs. A peer will continue to forward a message to any number of other peers until its copy of the message times out, it is notified of delivery by an acknowledgement, or the message is dropped due to a full buffer.

5. CONCLUSION

In this Paper technique available for lossless data transmission have been analyzed. A novel scheme to transmit the data efficiently without any loss of data and time delay has been proposed. This scheme supports cooperative caching in DTNs to enhance the chance of data access. The basic idea is to cache the data at set of Network Central Location in 4G network, which can be easily accessed by other nodes. The number of Network Central Location present in the network is important for the performance of caching. Here the number of number

of Network Central Location to be used for data transmission is optimized and NCLs selection is based on a metric. We are simulating the proposed technique in java and we hope that the data access delay and the data loss will be reduced to a great extent

6. REFERENCES

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