Volume 6, Issue 3, March 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Modelling and Analysis of Communication Traffic Heterogeneity in Opportunistic Networks and Fault Node Recovery

I. Gayathri[1], D. Sowmya[1], K. Sai Vikas[1], B. Meenakshi[1], T. Krishna Kishore[2]
[1] UG Scholar, [2] Asst. Professor,
[1, 2] Department of Computer Science & Engineering, St.Ann's College of Engineering & Technology, Chirala, Andhra Pradesh, India

Abstract: In opportunistic networks, direct communication between mobile devices is used to extend the set of services accessible through cellular or Wi-Fi networks. Mobility patterns and their impact in such networks have been extensively studied. In contrast, this has not been the case with communication traffic patterns, where homogeneous traffic between all nodes is usually assumed. This assumption is generally not true, as node mobility and social characteristics can significantly affect the end-to-end traffic demand between them. To this end, in this paper we explore the effect of traffic patterns on the performance of popular forwarding mechanisms, both analytically and through simulations. Among the different insights stemming from our analysis, we identify conditions under which heterogeneity renders the added value of using extra relays more/less useful. Furthermore, we confirm the intuition that an increasing amount of heterogeneity closes the performance gap between different forwarding policies, making end-to-end routing more challenging in some cases, or less necessary in others. To our best knowledge, this is the first effort to model, analyse, and quantify effects of traffic heterogeneity. We believe this is an important step towards better protocol design and evaluation of the feasibility of applications in opportunistic networks. We added fault node recovery that proposes, to enhance the lifetime of a wireless sensor networks when some of the sensor nodes shut down abruptly. The transmitted information to the fault node will be recovered; simultaneously the information will be reached to the destination in another path. It reduces the data lose by 98.8%.

Keywords: Opportunistic networks, traffic patterns, fault node recovery, traffic heterogeneity, relays, mobility patterns, performance.

I. INTRODUCTION

Opportunistic or Delay Tolerant Networks (DTNs) were initially envisioned to support communication in challenging environments, where infrastructure is limited or absent (e.g. emergency situations after disasters, mobile sensor networks). Lately, it has been suggested that they could also support or enhance existing networking infrastructure, e.g. by offloading traffic from cellular networks, enabling novel social and location-based applications, or introducing peer-to-peer collaborative computing. Opportunistic networks consist of mobile nodes (e.g. smart phones, laptops) that exchange data directly when they are *in contact* (i.e. within transmission range). Due to the limited range of direct communication (e.g. Bluetooth), communication is not continuous, and maintaining end-to-end paths is problematic. If nodes are not willing to relay 3rd party traffic, a message can only be transferred from a source node to a destination node when they come in contact (*direct transmission routing*). If other nodes are willing to collaborate, they could copy the message from the source (or another relay), *store* and *carry* it and, finally, *forward* it when they encounter the destination node. Such replication and relaying schemes could improve performance (*relay-assisted routing*), albeit at increased complexity and resource overhead. Since message exchanges take place only during contacts between nodes, mobility plays a major role both in the performance and the design of protocols and applications. As a result, sophisticated utility-based schemes have been proposed that select relays based on their mobility patterns and/or social characteristics. Furthermore, a lot of effort has been made recently to capture the mobility patterns of real networks. These mobility patterns can often greatly affect the performance of different schemes.

The communication traffic patterns used in studies of opportunistic networks have not received an equal amount of attention. It is usually assumed, implicitly or explicitly, that all traffic is uniform: each pair of nodes exchanges the same amount of messages. However, intuition suggests that traffic between nodes, just like contacts, cannot be expected to be homogeneous either. This is also supported by empirical studies on social networks, where the frequency of message exchanges might widely vary among pairs of nodes. Further, nodes that have a social relation or reside/move in the same areas, often tend to exchange more messages than others. Therefore, a number of interesting questions arise: How should one model the heterogeneity in communication traffic? Do heterogeneous traffic patterns affect the performance of information dissemination mechanisms and to what extent? Towards answering this question, in this project we investigate *if*, *when* and *how* traffic patterns affect the communication performance in opportunistic networks. Specifically:

- Examined what characteristics of traffic heterogeneity can have an effect on performance, and show that only when (end-to-end) traffic demand is correlated with pair wise contact rates performance is affected. Based on these findings, we propose an analytically tractable model that can describe a large range of non-uniform traffic patterns.

- Derived analytical expressions for calculating the joint effect of traffic and mobility heterogeneity in the performance of basic forwarding mechanisms.
- Used these expressions to show that the common understanding about these mechanisms, e.g. the gains from having additional replicas, might radically change when traffic is heterogeneous.
- Validated analytical findings through simulations and, by applying them to datasets of real-world networks that contain information about the mobility and communication patterns of participating nodes.
- Finally, presented possible extensions of our study, and discuss related work and further research directions on traffic patterns for opportunistic networking. To our best knowledge, this is the first attempt to model end-to-end traffic heterogeneity and analytically study its (quantitative and qualitative) effects on the performance of opportunistic communications. Our analytical findings, as well as simulation results, reveal important aspects of opportunistic networking that have not been explored or have not been taken into account in previous studies:

− When frequently meeting node pairs tend to exchange (on average) more/less traffic than other nodes, the communication performance can considerably differ from the homogeneous case. Taking into consideration such traffic patterns allows to better design or tune routing protocols.

− The effects on some forwarding mechanisms, like Direct Transmission, can be significant, while at the same time flooding (e.g. Epidemic) or routing (e.g. Spray and Wait, EBR) protocols are less affected. In particular, an increasing amount of heterogeneity closes the performance gap between the best (Epidemic) and the worst (Direct Transmission) forwarding.

− Under certain conditions, the impact of traffic heterogeneity can be so important, that it can lead to a reconsideration of the employed communication mechanisms, and even the feasibility of applications (e.g. online social messaging, file sharing, service composition) over opportunistic networking.

II. RELATED WORK

The structure consists of server, client, and router and graph modules. Where server concentrates on viewing the clients in chat, uploading the files, viewing the client request based on the request sends the file to the client. The client will participate in chat, views the files uploaded by server, sends request to server, and selects the path to receive the file. The router will concentrate on the routing the files from source to destination. Fault node recovery will be done manually. The graph is the part of the router the graph will be displayed based on starting time from sender and received time at destination by considering fault node also. The performance is calculated in milliseconds.Homogeneous Traffic is assumed that is not possible while communicating the nodes in the network may contain different configurations and operating systems. Assumes the node has not effect on communication. The mobility patterns were only studied. There is no fault node recovery and simultaneous communication because of that there is a chance of information loss or when the node get fault its take long time to recover the node until that the client not wait.

III. PROPOSED WORK

The proposed system consists of the heterogeneous networks which will be there in real time. The node mobility and social characteristics can significantly affect the end-to-end traffic demand between them. In this paper we explore the effect of traffic patterns on the performance of popular forwarding mechanisms, both analytically and through simulations. This is the effort to model, analyse ,and quantify effects of traffic heterogeneity. We believe this is an important step towards better protocol design and evaluation of the feasibility of applications in opportunistic networks. We added fault node recovery that proposes ,to enhance the lifetime of a wireless sensor networks when some of the sensor nodes shut down abruptly. The files that are send through the router or node that are fault, are send through another with simultaneous recovery of the node. It reduces the data lose by 98.8%.

3.1 Structure of Proposed System:

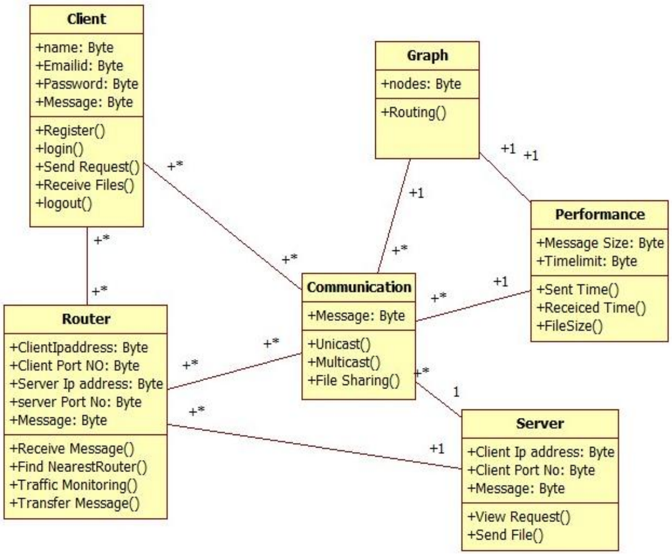

Fig 1. Class Diagram for Proposed system

3.2 Algorithm:

(Fault node recovery)

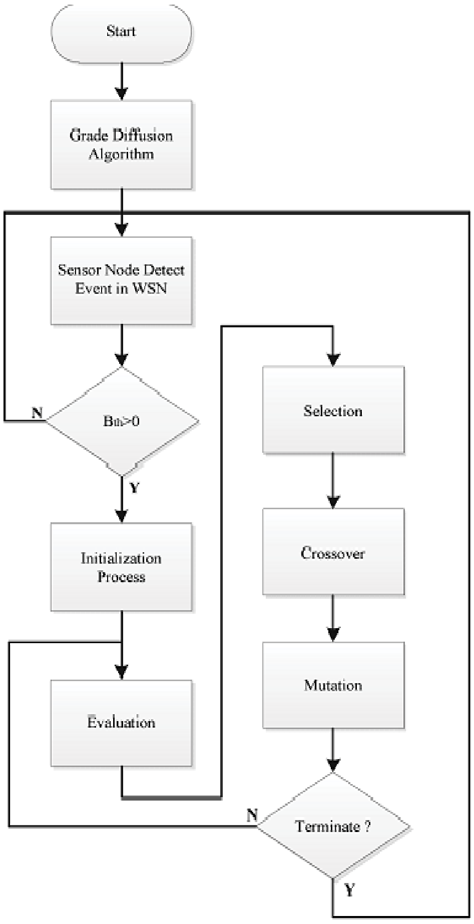

Fig 2. Algorithm Related to Fault Node Recovery

IV. RESULTS & DISCUSSIONS

Fig3. Server Page

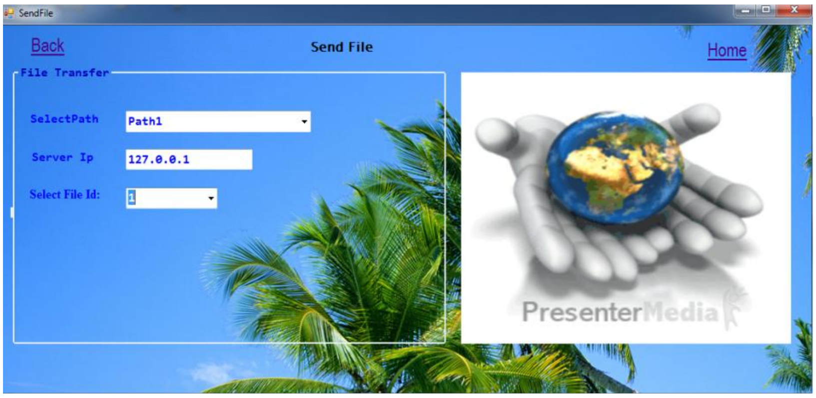

Fig4. Server Flie Transfer Page

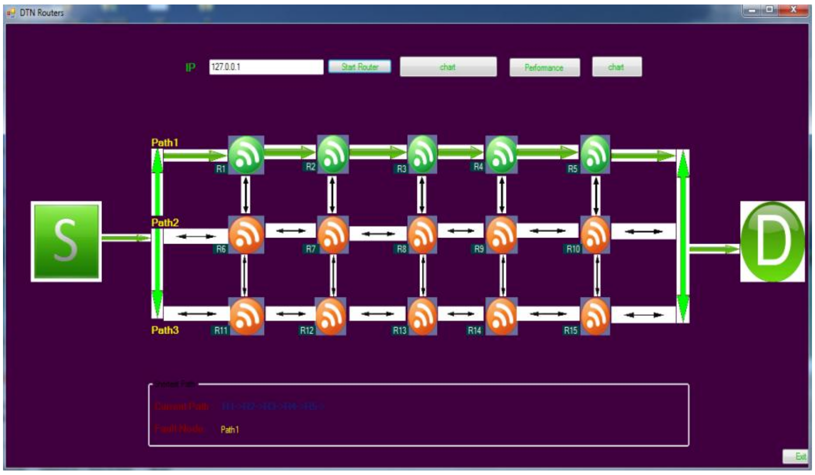

Fig5.Router Page

Fig6.Performance related to file transfer from sender to receiver

V. CONCLUSION & FUTURE WORK

The communication within the nodes in the network which contains short-range the advantage behind it is to communicate with the nodes having different configurations and operating systems. The node mobility and the communication traffic effect on the communication. The communication patterns are studied and the performance of the file transfer will be displayed by which the performance will be analyzed.For a more complete characterisation of traffic demands in opportunistic networking (either for end-to-end or content-centric applications), we believe that further experimental (e.g. measurements, recognition of traffic patterns in available datasets, etc.) and analytical research is needed.

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