Model and Analysis of Joint Model in Delay Network

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ABSTRACT-*In opportunistic networks, direct communication between mobile devices is used to extend the set of services accessible through cellular or WiFi 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 joint effect of traffic patterns and node mobility 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, analyze, 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.*

Keywords—opportunistic networks, delay tolerant networks, performance analysis, heterogeneous mobility, heterogeneous traffic

1. INTRODUCTION

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. smartphones, 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* [4]). 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. Summarizing, our main motivation for this model is to maintain the analytical tractability properties of standard models, while also integrating some mobility heterogeneity, whose joint effect with traffic heterogeneity we want to investigate. To ensure that our assumptions do not confound the conclusions drawn from our analysis, we will validate our results against real measurement traces, where many of these assumptions are known to not hold.

2 NETWORK MODEL

2.1 Mobility

We consider a network N, where N nodes move in an area, much larger than their transmission range. Data packet exchanges between a pair of nodes can take place only when they are in proximity (*in contact*). Hence, the dissemination of a message is subject to nodes mobility and the resulting *contact events*. To model this sequence of contact events, we will assume the following *class* of heterogeneous contact model.

2.2 Communication Traffic

The end-to-end traffic demand (per time unit) between a pair of nodes is a random variable. Hence, traffic demand between node pairs can differ and is on average correlated with the nodes contact rate. Intuition suggests that every pair of node will not exchange the same amount of traffic. To support intuition, studies from fields related to technological and social networks.

3. SYSTEM ANALYSIS

3.1 Existing System

We examine 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. To support intuition, studies from fields related to technological and social networks have demonstrated the existence of heterogeneous traffic patterns.

4. KNOWLEDGE JOINT EFFECTS MODEL (JEM) ALGORITHM

1. Joint Effect Model (JEM) is a Window based software Program. It is the only accredited DOD computer-based tactical.
2. It may be used in two variants: as a standalone system, or as a resident application on host command, control, communications, computers, and intelligence systems.
3. It is capable of modeling hazards in various scenarios, including counterforce, passive defense, accidents, incidents, high-altitude releases, urban environments, building interiors, and human performance degradation.

5. ANALYSIS

Consider now an opportunistic network with mobility and traffic according to the definitions of Section 2.To calculate a performance metric for this network, e.g. the expected delay ,one would consider a large number of messages generated between various source-destination pairs. Therefore, one would further need to know the contact rates between the sources and destinations of these messages. If a message was equally likely to be generated between any pairs of nodes, then the contact rate between the source and destination of this message should be distributed as (Def. However, if messages are more like to come from a frequently meeting pair rather than an “average” pair, then the source-destination contact rate (we refer to it as the *effective* contact rate) would be biased towards higher values.

6. CONCULSION AND FUTUREWORK

We believe that our study provides an initial understanding on the effects of traffic heterogeneity. However, traffic patterns in real networks might have much more complex characteristics than what can be captured by our frame work, e.g. time-dependent traffic/mobility correlations. Therefore, 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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