#33 (1569614347): *Traffic Distribution and Network Capacity Analysis in Social Opportunistic Networks*

BibTeX

Property	Change Add	Value
Conference and *track*		**2012 Fifth International Workshop on Selected Topics in Mobile and Wireless Computing** - *Fifth International Workshop on Selected Topics in Mobile and Wireless Computing*
Authors		

Name	ID	Edit	Flag	Affiliation (edit for paper)	Email	Country

	Name	ID	Edit	Flag	Affiliation (edit for paper)	Email	Country
	Bambang Soelistijanto	731989			Sanata Dharma University, Indonesia	b.soelistijanto@usd.ac.id	Indonesia
	Michael P. Howarth	101485	not creator		University of Surrey, United Kingdom (Great Britain)	m.howarth@surrey.ac.uk	United Kingdom (Great Britain)

Title	Only the chairs can edit	*Traffic Distribution and Network Capacity Analysis in Social Opportunistic Networks*
Abstract	Only the chairs can edit	Social opportunistic networks are intermittently connected mobile ad hoc networks that exploit human mobility to physically carry messages between disconnected parts of the network. Human mobility thus plays an essential role in the performance of forwarding protocols in the networks, since people's movements are affected by their social interactions with each other. This paper presents an analysis of traffic distribution among the nodes of social opportunistic networks and its impact on network capacity. For our analysis, we use a human contact graph that represents a social network of individuals. We characterize the graph as a scale-free network and apply forwarding strategies based on the information required by a node to select relays for its messages, categorising this information either as isolated or complete network or local network knowledge. We use a social network property, centrality, for the forwarding strategies, additionally considering tie strength in the forwarding metric and investigate their impact on traffic distribution. We show that all the strategies result in unfair traffic distribution due to a strong non-random structure of the networks where hub nodes process much more relay traffic than non-hub nodes. Finally, we present a mathematical model of network capacity as an upper-bound of network delivery performance where hub nodes' resources become the limiting factors, and show that including tie strength in the forwarding metric improves the network capacity.
Keywords	Only the chairs can edit	opportunistic networks, traffic distribution, network capacity, scale-free graph, centrality, tie strength
Status		no status
Final manuscript		However, authors cannot upload: paper status

Document (show)	Pages	File size	Changed

232,278 Sep 16, 2014 19:11 America/New_York

Personal notes

You are the creator and an author for this paper.

Reviews

3 Reviews

Review 1

Reviewer Familiarity?	Technical Contribution	Originality/Novelty	Quality of Presentation	Overall recommendation
Familiar with this area of research (2)	Average (3)	Average (3)	Above average (4)	Accept if Room (3)

Comments (Please justify here your rating of the paper. What are its strengths and weaknesses? Note that these comments will be sent to the authors.)

This reviewer found this paper well written and technically sound. The authors present an analysis of social-based contacts to improve routing in Opportunistic Networks.
There were some aspecst the authors might want to look at, but first of all, this reviewer is curious about the reasons not to mention DTN in the work, and call them ICN. Most of the related work on this are refers to them as DTNs.
Below there is a list of issues which were not clear to this reviewer. The authors might want to take a look at them if the paper gets finally accepted.
1) Most of the rationale for this work is the use of highly dynamic networks, where links are very intermitent. However, it seems that the evaluation was carried out over particular network deployments, without considering node mobility, which is something which this reviewer would expect on this type of topologies.
2) It is neither clear how the corresponding source/destination pairs for the various traffic flows influence the results. The Poisson model which is used makes sense (for the sake of analysis), but it is not clear whether there might be any impact if considering traffic coming from A PARTICULAR node to A PARTICULAR node and modeling the probabiliy of using others as intermediate relays might be also worth discussing in the paper. In this not clear which is the impact of node connectivity (existence of links) on the transition matrix.
3) The paper is well written although, for the sake of completeness it would be good to add more details about the binary scale free network.
4) The authors divide the traffic arriving a node into messages coming from other nodes and those created by itself, it was a bit weird that these last ones are qualified as "arriving" and not "departing", right?
5) The simulations are carried out over 10 different (independent?) topologies. Is this enough to ensure statistical validity of the results? It would be nice to see the variance or the confidence interval of the achieved results.

Review 2

Reviewer Familiarity?	Technical Contribution	Originality/Novelty	Quality of Presentation	Overall recommendation
Familiar with this area of research (2)	Average (3)	Average (3)	Average (3)	Accept (4)

Comments (Please justify here your rating of the paper. What are its strengths and weaknesses? Note that these comments will be sent to the authors.)

This paper explores in my opinion an interesting trend in modern communication networks. That is, the use of mobile devices in persons that carry any way they move in their normal life, along the city or surrounding villages. Although the study focus just on the model, it could be a good help for better understanding or improving new protocols based on relay communications where in case of non line of sight the communication uses near host to forward and reach the destination.

Review 3

Reviewer Familiarity?	Technical Contribution	Originality/Novelty	Quality of Presentation	Overall recommendation
Working in this area of research (3)	Below average (2)	Excellent (5)	Average (3)	Accept if Room (3)

Comments (Please justify here your rating of the paper. What are its strengths and weaknesses? Note that these comments will be sent to the authors.)

The paper presents an analytical study of the capacity of opportunistic networks characatrized by social ties. I found the paper well written and interesting in its first part, where the state of the art is presented and the motivation is provided. However, despite the interesting and timely topic, the actual scientific contribution in the second part of the paper is affected by arbitrary choices and does not feel mathematically sound.

In particular, the whole analysis is based on the "Onella weak-tie hypotesis" that links with high betweeness centrality (BC) have low connection time. The results of the weighted network are highly consistent with this hypotesis, which however remains in fact an hypotesis. There is no clear indication whether the Onella hypotesis applies to the social opportunistic networks in real-world. This aspect should be addressed by the authors, who have to prove that high BC yields low connection time in real-world networks. In absence of such a proof, the interest of the results is questionable.

As a second and correlated point, the mapping between BC and tie strength, in Algorithm 1, appears arbitrary. The proposed mapping only result in loose coupling of BC and tie strength, in a way that is impossible to quantify since it depends on the exact probability distribution of BC in the network. A much sounder way to proceed would be to analyse real-world opportunistic networks (e.g., through real-world mobility datasets), determine the exact correlation between BC and connection time (thus validating - or invalidating? - the Onella hypotesis) and exploiting the correlation result to perform the mapping between BC and tie strength.

Another critical aspect is the model proposed in Sec.IV, which appears confuse and incoherent. The authors provide one definition of the load at node i, \alpha_i, in (9), and then a different one in (12). The procedure is thus not clear at all, since (9) results in a system of equations through which one could determine the \alpha_i's for all i. Instead, (9) is simply abandoned and the second definition is used in the remainder of the section.
The authors then introduce c_i, i.e., the service process at each node, whose definition is ambiguous to say the least. Apparently, the process with which a node "serves" a content (i.e., can pass it to another node, either the destination of a relay) depends on its encounters with other nodes in the network. However, this not seem to be the definition of the authors, although no idenication is given on how c_i is defined.
The service process is used to formulate an optimization process in (14), that accounts for both the delay and the network load. The problem has an obvious solution for c_i = 0 for all i, but this is not the major problem. In fact, the problem is discussed in equations (15)-(16) and then simply abandoned: the "final" result in (18) is just the result of the fact that the service rate c_i must be higher than the arrival rate \lambda at all nodes for the network to be stable. This result could be obtained from equations (10), (11), (12) and (18), so I do not see the need for all the other equations in the Section.
As I wrote before, the overall feeling is that Sec.IV is a bunch of very confuse mathematical formulas without a clear and rational flow.

Finally, the last major issue with the paper is that the performance evaluaiton completely disregards the latency of the data transfer. I.e., the authors conclude that some forwarding techniques are harmful, or that weighting the edges results in "better performance": however, all this is true only from a network capacity viewpoint. If delay is taken into account, the figures could be significantly different.

As minor remarks:
- the statement that the higher the PAR, the worse the traffic ditribution in the network (Sec.V-A) is false. An outlier could easily cause a high PAR in a very "concentrated" distribution.
- it is not clear to me why buffer congestion control (used by [10], [11] and [12]) is a problem, as the authors seem to imply in Sec.II. Please clarify.