Sustainable Communication Networks
Prof. Dr. Anna Förster

Connector Nodes in Opportunistic Networks

Prerequisites:	- Programming with C++
Reccomended background:	- Network Simulation course (OMNeT++) - Graph theory basics - Opportunistic networks basics
Level:	This topic is appropriate for Master Students
Language:	German or English

Introduction

In a famous experiment from 1969[2], Travers and Milgram have sent 296 letters to random people across the US. These people were asked to route the messages to an unknown to them person in New York by sending them to people who they believed could deliver the letter directly. For example, if they knew somebody living in New York, they could send the letter there. From all 296 letters, only 64 reached their target. Interestingly, 16 of these letters went through a particular merchant, Mr. G., who knew many people and delivered the letters directly. Mr. G. was a connector in this experiment.
Generally speaking, connector nodes in a graph are nodes, which connect different parts of the network with each other and are thus more important than others for routing or data dissemination. In opportunistic networks (OppNets)[1], data dissemination is implemented in the so called "store-carry-forward" approach. When nodes meet, they exchange information and carry it further to forward later. OppNets depend highly on the mobility of their users.

Project description

The research question of this student project is: Do connectors exist in OppNets? If yes, what are their main properties and how can they be recognised, e.g. do they have more contacts or maybe move more?
In order to answer this question, the student needs to use the existing delay-optimal data dissemination protocol for OMNeT++/OPS[3]. The methodology is straight forward: from a scenario with N nodes, we extract one node, re-run the simulation and store the results. After repeating this process for all N nodes, we can compare the results and identify which nodes are more important for the data dissemination, because their exclusion will impact the performance more than with other nodes.
This methodology needs to be repeated for several real-world mobility traces and for some random mobility models, such as random waypoint and SWIM.
Next, their mobility parameters need to be extracted, such as radius of gyration, number of contacts, etc. These parameters need to be compared with the importance factor identified before and conclusions need be drawn about which parameters are bets predicting the importance of nodes for forwarding.

Contact

If you are interested in this work, please contact us via mail: projects@comnets.uni-bremen.de

References

[1] Ó. Helgason, S. T. Kouyoumdjieva, and G. Karlsson. Opportunistic communication and human mobility. *Mobile Computing, IEEE Transactions on*, 13(7):1597–1610, July 2014.

[2] Jeffrey Travers and Stanley Milgram. An experimental study of the small world problem. *Sociometry*, 32(4):425–443, 1969.

[3] Asanga Udugama, Anna Förster, Jens Dede, and Vishnupriya Kuppusamy. Simulating Opportunistic Networks with OMNeT++. In Antonio Virdis and Michael Kirsche, editors, *Recent Advances in Network Simulation: The OMNeT++ Environment and Its Ecosystem*, EAI/Springer Innovations in Communication and Computing, pages 425–449. Springer International Publishing, Cham, 2019.