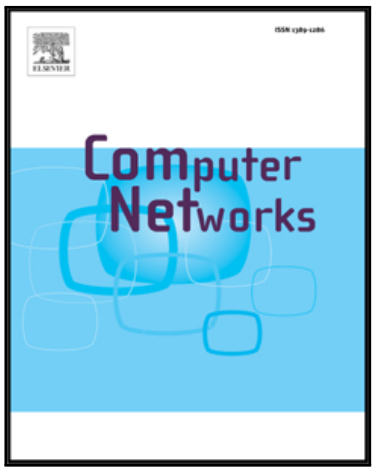

Connectivity with Backbone Structures in Obstructed Wireless Networks

Manassés Ferreira Neto, Olga Goussevskaia,
Vinícius Fernandes dos Santos

PII: S1389-1286(17)30341-9
DOI: 10.1016/j.comnet.2017.08.023
Reference: COMPNW 6296

To appear in: *Computer Networks*

Received date: 12 April 2017
Revised date: 7 August 2017
Accepted date: 29 August 2017

Please cite this article as: Manassés Ferreira Neto, Olga Goussevskaia, Vinícius Fernandes dos Santos, Connectivity with Backbone Structures in Obstructed Wireless Networks, *Computer Networks* (2017), doi: 10.1016/j.comnet.2017.08.023

Connectivity with Backbone Structures in Obstructed Wireless Networks

Manassés Ferreira Neto[a], Olga Goussevskaia[a], Vinícius Fernandes dos Santos[a]

[a] *Computer Science Department*
Universidade Federal de Minas Gerais
Belo Horizonte, Brazil
Email: {manasses,olga,viniciussantos}@dcc.ufmg.br

Abstract

In this work we consider a wireless ad-hoc network deployed on a finite street grid, where communication between nodes is disrupted by regularly spaced obstacles. The critical transmission range for connectivity in such networks grows with the size of the grid, which might impair the feasibility of low-power wireless technologies in large networks.We therefore analyze how the connectivity of such networks in sub-critical scenarios, where the transmission range is insufficient to establish connectivity, can be improved by introducing a global backbone with a set of access points. We formulate the problem of positioning a minimum number of access points, such that every connected component is covered by at least one access point, and refer to it as the Obstructed Wireless Network Backbone Cover Problem (OWN-BC). We prove that OWN-BC is NP-complete and present a 2-approximation algorithm to find solutions with guaranteed quality. Furthermore, we derive a lower bound on the probability of finding optimal solutions in random network scenarios. Finally, we perform a series of simulations to illustrate the performance of the approximation algorithm and characterize scenarios in which the proposed algorithm obtains optimal solutions in polynomial time.

Keywords: Ad-hoc networks, obstructed wireless networks, connectivity, backbone, NP-completeness, approximation algorithms

1. Introduction

Ad hoc wireless networks in practice often have to operate in obstructed environments, where the propagation of the signal cannot be described by