Simulating obstructed wireless networks with COOJA extended

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Abstract. *This paper describes the use of the simulator COOJA extended throw a class made by the authors with intents to study obstructed wireless networks.*

Resumo. *Este artigo descreve o uso do ambiente de simulações COOJA estendido por uma classe feita pelos autores com o intuito de estudar redes sem-fio com obstáculos.*

1. General Information

In this work, we analyze an alternative model for obstructed wireless networks.

The model is based on a grid structure of one-dimensional street segments and two-dimensional street intersections. This structure provides a realistic representation of a variety of network scenarios with obstacles and, at the same time, allows a simple enough analysis.

In the first part of this work, we implemented an abstract medium at COOJA named UDGO gathering two pre-existing models UDGM and MRM. [Osterlind et al. 2006]

UDGM inserts the Unit Disk Graph behaviour, being more simplist. MRM leads with the physical aspect of the transmission, being much more complex.

In the second part, we will lead simulations to study the Critical Transmission Range for Connectivity CTR r_c. Comparing the analytical provided by [Almiron et al. 2013] with the experimental that will be obtained by the authors using the extended COOJA. We pretend explore those parameters values:
$T = 20, 30, 35, 28, 70$
$g = 2, 6, 8, 12$
$\mu = 6, 8, 10, 12, 14, 16, 18$
$\epsilon = 10$

Due the long time spent it with the simulations, we are dedicating to distribute the computation using a simple server-client protocol routine made it from scratch by the authors.

Furthermore, we will study forms to efficiently handles with the visibility calculations. That are at this moment very expensive, mainly for the MRM model. At moment, we are investigating the shifting-strategy with dynamic-programming described at [Erlebach et al. 2005].

2. Expected Results

We expect discover some insights with the introduced physical medium UDGO that could feedback the model. One thing that could happen it will be the experimental CTR be lower than the analytical. Due the physical properties introduced with MRM that could make visibility increase.

3. Steps and Schedule

Job - thread1	Job - thread2	Due Date
HardDeadLineCallForPaper-poc2		2014-09-06
	Tests for Scripts that Automate Sample Generation and Sample Analize	2014-09-10
Preliminaries Tests For Parameters Max Limits	Client-Server App to running thes scripts and make control of the simulations	2014-09-13
starts simulations with the Parameters that run in reasonable time	study the viability of shifting-strategy, dynamic-programming to our problem of efficiently handle visibility	2014-09-17
		2014-09-20
		2014-09-24
DeadLinePresentation		2014-09-27
gather data, make charts and analize	if sounds good implement the new visibility approach	2014-10-01
		2014-10-04
		2014-10-08
		2014-10-11
DeadLineMicrosoftAzureForResearchAward	starts simulations with bigger Parameters to test the new visibility approach	2014-10-15
starts other simulations with the Parameters that run in reasonable time based on the analysis		2014-10-18
		2014-10-22
		2014-10-25
gather data, make charts and analize	gather data, make charts and analize	2014-10-29
		2014-11-01
		2014-11-05
		2014-11-08
DeadLinePoster		2014-11-12
		2014-11-15
DeadLineReport		2014-11-19
		2014-11-22
DeadLineCallForPaper-sbrc2015-register		2014-11-26
		2014-11-29
DeadLineCallForPaper-sbrc2015-submission		2014-12-03
		2014-12-06

Figure 1. Schedule

4. References

4.1. Obstructed Wireless Networks

Model and Analytical CTR: [Almiron et al. 2013]

4.2. COOJA

UDGM, MRM: [Osterlind et al. 2006]
Contiki: [Dunkels et al. 2004]

4.3. Unit Disk Graphs

UDG Tractability Theory:[Clark et al. 1990]

4.4. Geometric Graphs

Aproximation Algorithm candidate: [Erlebach et al. 2005]

4.5. UDGO

Our code: https://github.com/mfer/udgo.git

References

[Almiron et al. 2013] Almiron, M. G., Goussevskaia, O., Loureiro, A. A., and Rolim, J. (2013). Connectivity in obstructed wireless networks: From geometry to percolation. In *Proceedings of the Fourteenth ACM International Symposium on Mobile Ad Hoc Networking and Computing*, MobiHoc '13, pages 157–166, New York, NY, USA. ACM.

[Clark et al. 1990] Clark, B. N., Colbourn, C. J., and Johnson, D. S. (1990). Unit disk graphs. *Discrete Mathematics*, 86(1 - 3):165 – 177.

[Dunkels et al. 2004] Dunkels, A., Gronvall, B., and Voigt, T. (2004). Contiki - a lightweight and flexible operating system for tiny networked sensors. In *Local Computer Networks, 2004. 29th Annual IEEE International Conference on*, pages 455–462.

[Erlebach et al. 2005] Erlebach, T., Jansen, K., and Seidel, E. (2005). Polynomial-time approximation schemes for geometric intersection graphs. *SIAM J. Comput.*, 34(6):1302–1323.

[Osterlind et al. 2006] Osterlind, F., Dunkels, A., Eriksson, J., Finne, N., and Voigt, T. (2006). Cross-level sensor network simulation with cooja. In *Local Computer Networks, Proceedings 2006 31st IEEE Conference on*, pages 641–648.