Obstructed wireless networks with COOJA extended

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Introduction

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 About the use of the simulator COOJA extended throw a class made by the authors with intents to study obstructed wireless networks

Related Work

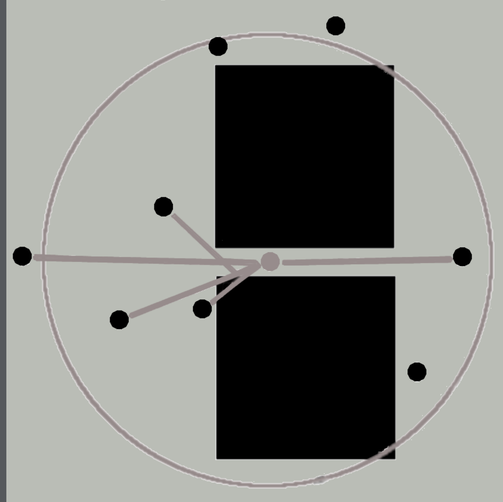
- Model and Analytical CTR: [Almiron et al. 2013]

$$r_c = \frac{ln(g) + ln(\mu - 1)}{\mu}, \epsilon \geq \epsilon_c$$

- UDG Tractability Theory:[Clark et al. 1990]
- Aprox. Algorithm for Visibility Improvement: [Erlebach et al. 2005]

Results

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 calcu- lations. That are at this moment very expensive, mainly for the MRM model. At mo- ment, we are investigating the shifting-strategy with dynamic-programming described at [Erlebach et al. 2005]



```
static const struct broadcast_callbacks broadcast_call = {broadcast_recv};
/*---------------------------------------------------------------------------*/
PROCESS_THREAD(broadcast_process, ev, data)
{
  static struct etimer et;
  static uint8_t seqno;
  struct broadcast_message msg;

  PROCESS_EXITHANDLER(broadcast_close(&broadcast);)

  PROCESS_BEGIN();

  broadcast_open(&broadcast, 10, &broadcast_call);

  while(1) {

    /* Send a broadcast every 8 - 16 seconds */
    etimer_set(&et, CLOCK_SECOND * 8 + random_rand() % (CLOCK_SECOND * 8));

    PROCESS_WAIT_EVENT_UNTIL(etimer_expired(&et));

    msg.seqno = seqno;
    packetbuf_copyfrom(&msg, sizeof(struct broadcast_message));
    broadcast_send(&broadcast);
    seqno++;
  }

  PROCESS_END();
}
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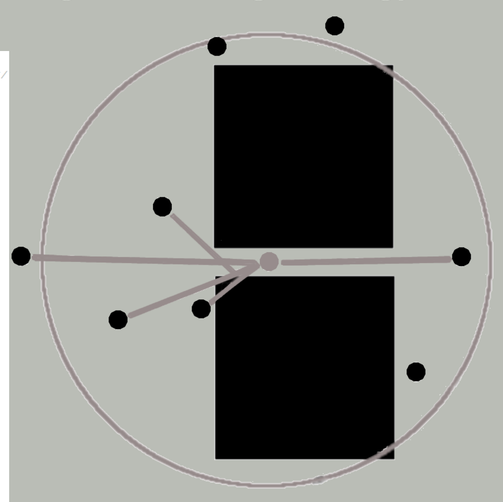


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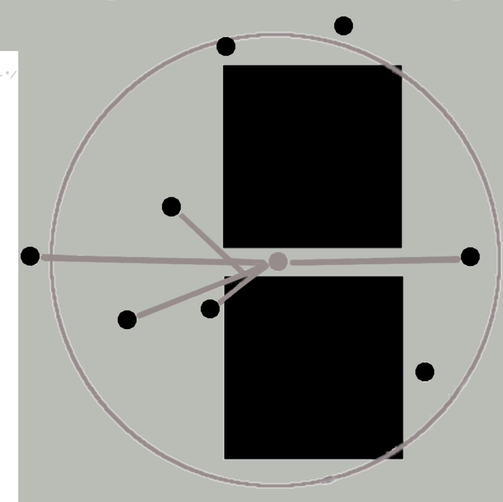


Questions we made

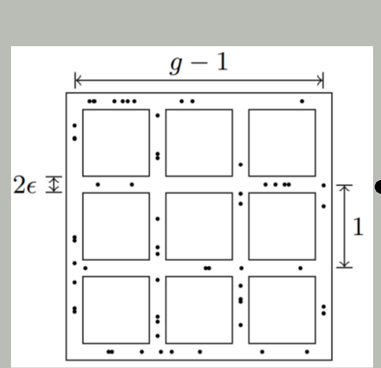
Analytical CTR will be greater than experimental?
Physical aspects of MRM could increase the visibility?
And the connectivity?
For the same properties, what the interference will cause?
How can we feedback model by the physical UDGO?

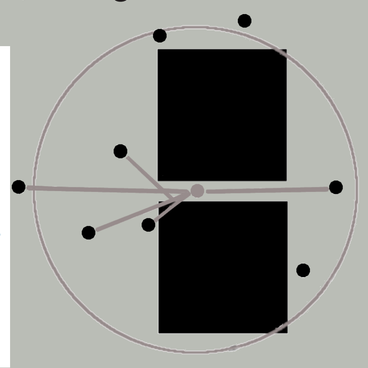
Answers we get

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

POC1

On 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 simple. MRM leads with the physical aspect of the transmission, being much more complex



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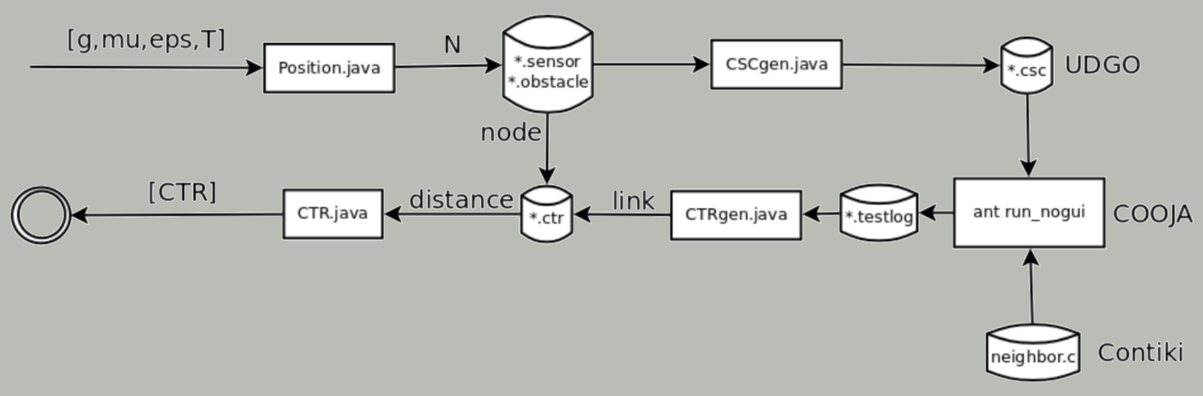
- Experimental: UDGO **https://github.com/mfer/udgo**
- Experimental: simulation in batch-mode
- Analytical: model and analytical CTR on obstructed networks



POC2

On the second part, we performed simulations to study the Critical Transmission Range for Connectivity CTR. Comparing the analytical provided by [Almiron et al. 2013] with the experimental that will be obtained by the authors using the extended COOJA.

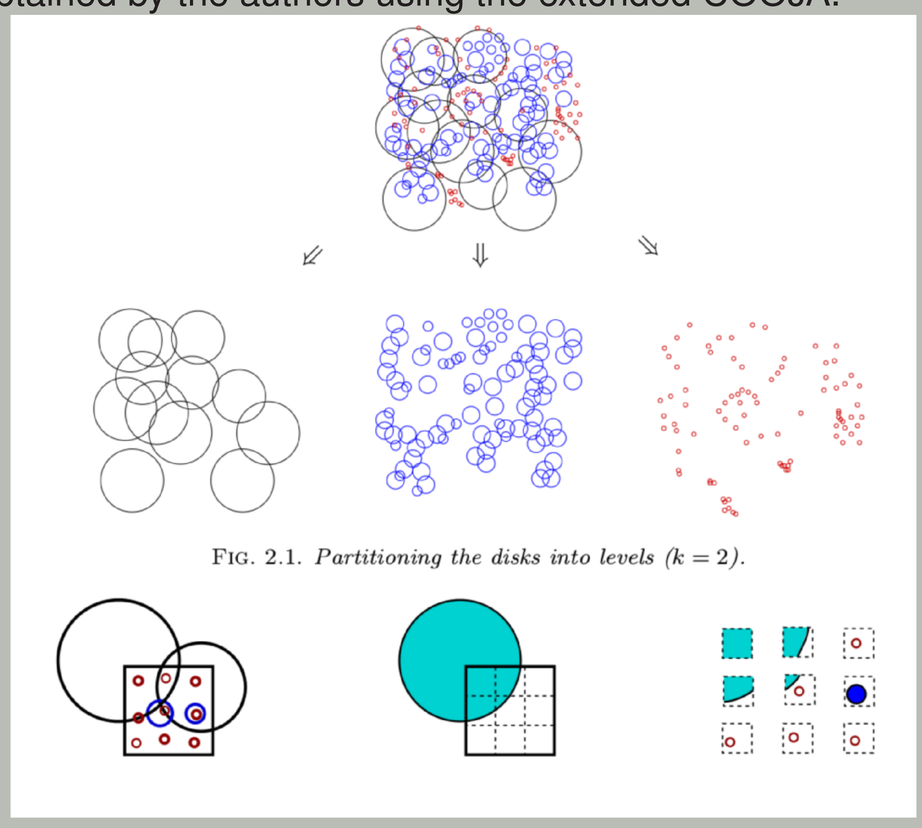


FIG. 2.1. *Partitioning the disks into levels* ($k = 2$).

- Experimental: client-server
- Experimental: simulations
- Analytical: PTASGIG **https://github.com/mfer/ptasgig**

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 ACM, MobiHoc, pages 157-166, New York, NY

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.

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