UM-CRT model optimisation

Slimane Bouhadi, Jonathan Ledy, Anne-Marie Poussard

▶ **To cite this version:**

Slimane Bouhadi, Jonathan Ledy, Anne-Marie Poussard. UM-CRT model optimisation. Journées Nationales des Communications dans les Transports Terrestres, Nov 2011, Colmar, France. hal-00658998

HAL Id: hal-00658998
https://hal.science/hal-00658998

Submitted on 13 Jan 2012

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Copyright

UM-CRT model optimisation

Slimane Bouhadi[#], Jonathan Ledy[#*], Anne-Marie Poussard[#]

[#] *Laboratoire XLIM-SIC, UMR CNRS 6172, Université de Poitiers, France*
[*] *Laboratoire MIPS-GRTC, Université de Haute-Alsace, France*
jonathan.ledy@univ-poitiers.fr

***Abstract*— Many research on VANETs present new propagation models. This paper focus on the last optimisation of the UM-CRT model proposed by the XLIM-SIC Laboratory. The model is simplified in order to obtain a faster computation time without reducing the realism of the UM-CRT model and new criteria computed from the impulse response are also shown.**

I. Introduction

Vehicles wireless networks are called Vehicular Ad-hoc NETworks (VANETs). Finding an accurate channel model for VANETs simulations is an important research issue [1].

This short paper is organised as follows. Section II give a brief overview of the UM-CRT semi-deterministic model. Section III present the optimisation of the model and shows some results. Finally section IV conclude the paper.

II. UM-CRT Model

In [2], Ledy et al. proposed a semi-deterministic solution which benefits from both advantages of statistical and deterministic channel models. This new model is called UM-CRT because it is based on the statistical Spacial Channel Model Extended in it's Urban Micro (SCME-UM) environment [3], and deterministic Communication Ray Tracer (CRT) simulator [4].

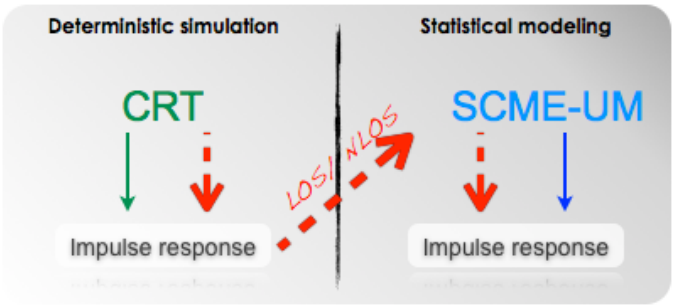

Figure 1. Principle of the UM-CRT model

Figure 1 shows the relationship between UM-CRT and both CRT and SCME-UM. For all radio links existing between nodes, CRT computes Impulse Responses (IRs) of all the received multi-paths according to a 3D environment. On the other hand, SCME-UM provides statistically generated IRs. Ledy et al. proposed to limit the search path by ray-tracing only to the direct path because it is well known that this path has the main impact on the received signal.

III. Model Optimisation and new criteria

In the previous UM-CRT build, the Line Of Sight (LOS) criteria was determined using the computed delay of the first IR for each links. We modified it to create an IR only in LOS cases, so the Non LOS cases do not need to be computed.

Using this new build, two simulations with 20 nodes moving at 15m/s with 3 simultaneous communications takes less than 1 minutes while it took 3 minutes with the oldest build. Preliminary test shows that optimised UM-CRT and original UM-CRT give the same results in term of behaviour.

In addition to this optimisation, we also compute from the IRs two new metrics that are the Capacity and Probability of Outage. They are both good indicators of the quality of radio links and could be combined with LOS/NLOS criteria.

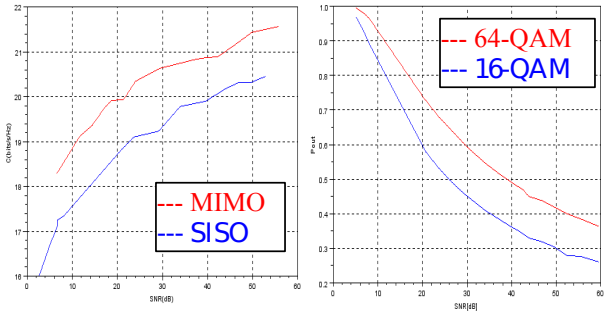

Figure 2. Capacity and Probability of Outage versus Signal to Noise Ratio

Figure 2 shows the two metrics depending on the SNR. The Capacity of Outage is computed for MIMO and SISO technologies, as the Probability of Outage is computed for 16 and 64 QAM modulation. We can therefore see that these indicators accurately reflects the properties/quality of the channel.

IV. Conclusions

In this paper, we presented an optimisation for the UM-CRT model. We showed that the results of this optimisation are very similar to the standard one, and that the simulation time had been improved. New criteria that may be used in combination with the LOS-NLOS criteria are also presented.

References

[1] F. J. Martinez, C.-K. Toh, J.-C. Cano, C. T. Calafate and P. Manzoni, "Realistic Radio Propagation Models (RPMs) for VANET Simulations", IEEE Wireless Communications and Networking Conference 2009, Mar. 2009.

[2] J. Ledy, H. Boeglen, A-M. Poussard, B. Hilt, R. Vauzelle, "A Semi-Deterministic Channel Model for VANETs Simulations", International Journal of Vehicular Technology, Volume 2012

[3] D. S. Baum, J. Hansen, J. Salo, "An interim channel model for beyond-3G systems: extending the 3GPP spatial channel model (SCM)", 2005 IEEE 61st Vehicular Technology Conference, VTC 2005-Spring, volume 5, pp. 3132-3136, 2005.

[4] F. Escarieu, V. Degardin, L. Aveneau, R. Vauzelle, Y. Pousset, M. Lienard, P. Degauque, "3D modelling of the propagation in an indoor environment : a theoretical and experimental approach", pp 217-220, ECWT'2001, London, UK, Sept. 2001.