
Radio Irregularity Model in OMNeT++

Behruz Khalilov, Anna Förster and Asanga Udugama

University of Bremen, Germany

OMNeT++ Community Summit 2017

University of Bremen, Germany

September 07 – 09, 2017

Contents

- Motivation
- Radio Irregularity Model
- RIM Architecture in INET
- INET Implementation of RIM
- Evaluations
- Summary and Future Work

Motivation

- Wide range use of Wireless Sensor Networks in various domains
 - Over 200 billion devices by 2020
- Radio Irregularity is a non-negligible phenomenon
 - Direct impact on a protocol performance
 - Asymmetric link
 - Loss of packets
- Large scale of Devices in the WSN - Large
 - Require simulators – OMNeT++
- Most of existing simulation models assume a spherical radio pattern
 - Free Space Path Loss

RIM Model

G. Zhou et al, *Models and Solutions for Radio Irregularity in Wireless Sensor Networks*, ACM Transactions on Sensor Networks, May 2006

Radio Irregularity Model

- Introduces real data into simulations
 - Hybrid approach
- Enhances isotropic radio models by targeting three main parameters
 - Anisotropy
 - Continuous variation
 - Heterogeneity
- DOI – the degree of irregularity is introduced to denote the irregularity of a radio range

RIM Architecture in INET

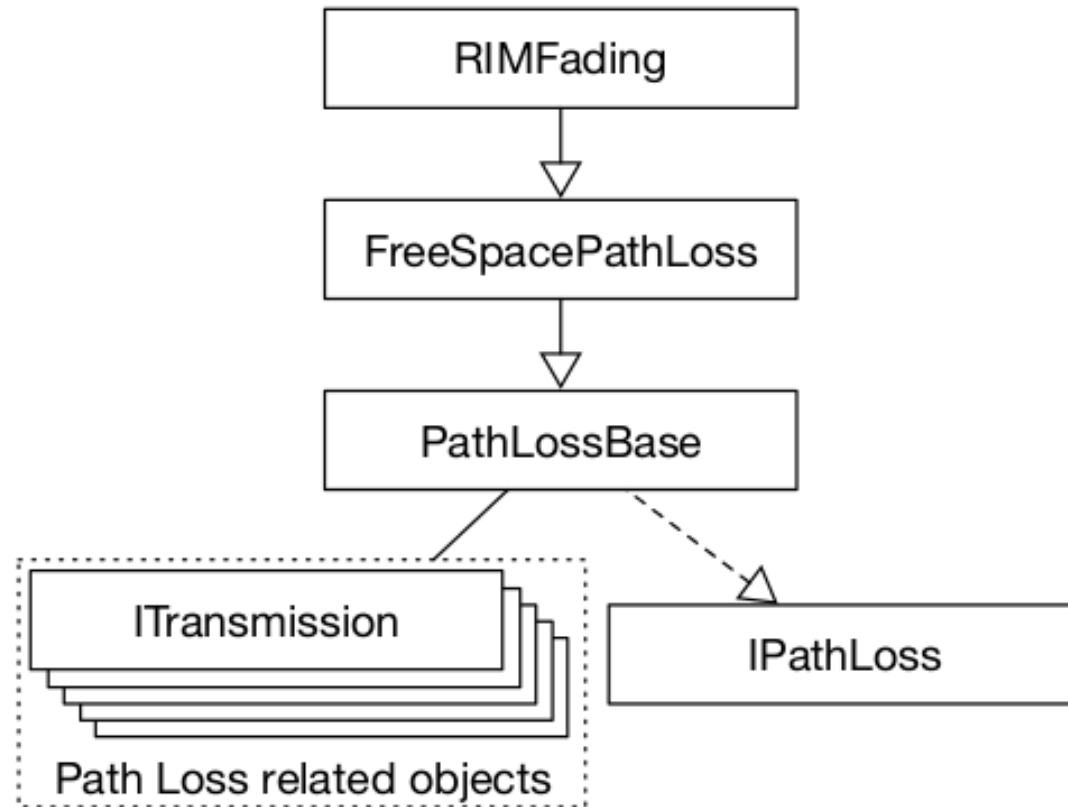


Fig. 1. Class inheritance diagram of the RIM implementation

RIM Implementation

- Extends the FreeSpacePathLoss (FSPL)
- Main algorithm:
 - Compute the path loss using FSPL
 - Compute angle between sender and receiver
 - Use the RIM Model to compute the DOI-adjusted path

ReceivedSignalStrength = Sending Power – DOIAdjustedPathLoss + Fading

*DOIAdjustedPathLoss = PathLoss * K_i*

$$K_i = \begin{cases} 1; & i = 0. \\ K_i \pm Rand * DOI; & 0 < i < 360^\circ \\ |K_0 - K_{359}| \leq DOI \end{cases}$$

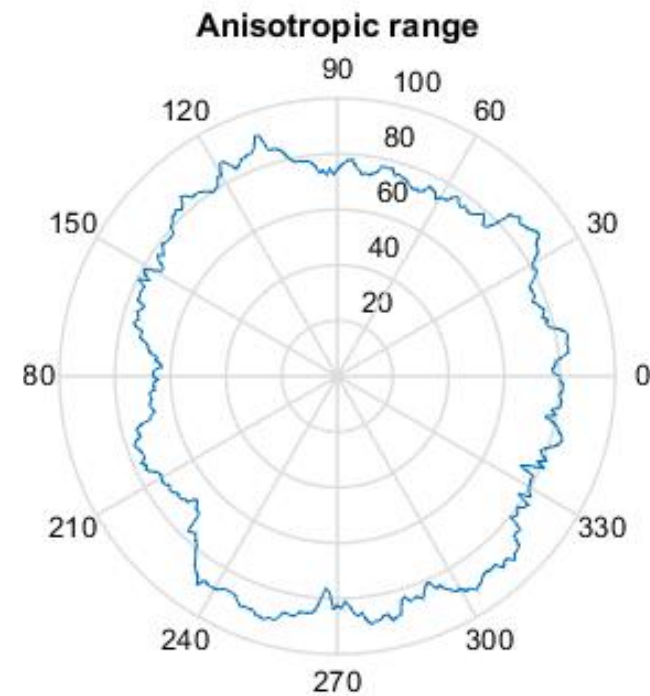
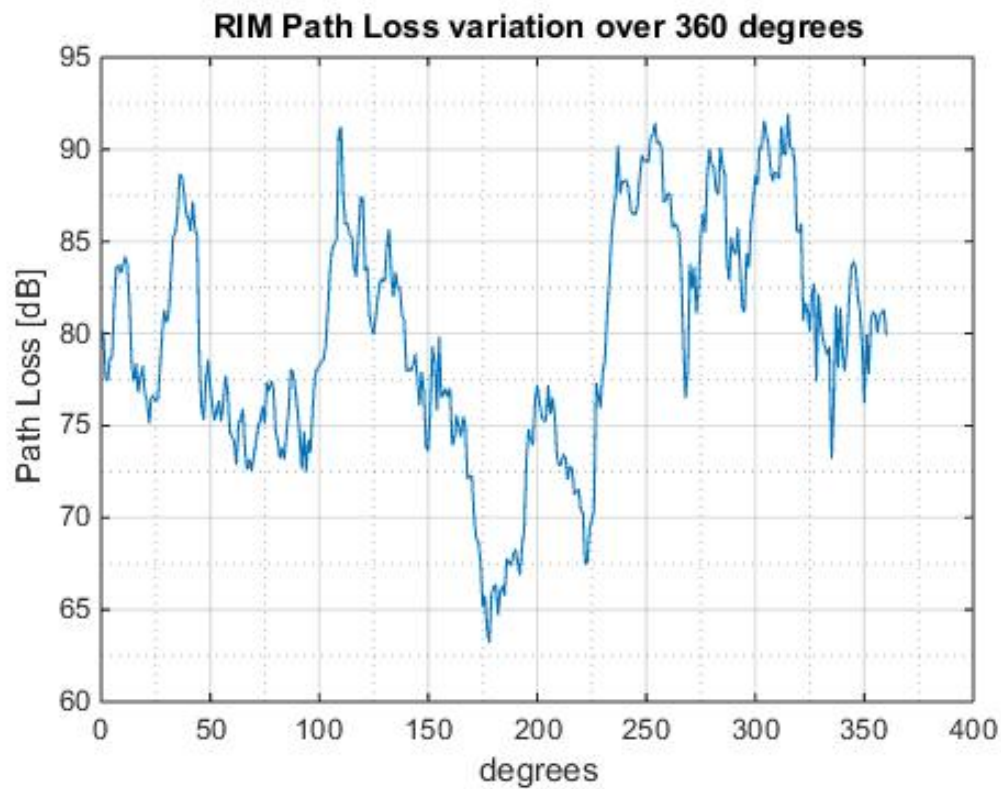
Coefficients of irregularity (k_i) are pre-computed!

Parameters

- **Random** numbers are generated using the Weibull distribution
- **a**– The scale parameter of the Weibull distribution.
- **b** – The shape parameter of the Weibull distribution
- **DOI** – The degree of irregularity

Evaluations

- Represents the variation of path losses in a different directions



Summary

- RIM – illustrates the irregularity of a radio range.
- Based on real dataset
- Estimates path losses in an anisotropic environment
- Purpose of this work – implementation of the RIM model in OMNeT++
- Currently available at Github (search: **RIMFading**)

Future Works

- RIM is limited in a space domain. The effect of time is neglected.
- The model does not consider any obstacles in between

Thank You.