Cross-level energy model for power-aware Wireless Sensor Networks design

Michel Bakni, Octavian Curea, Guillaume Terrasson, Alvaro Llaria, Jessye Dos Santos
Univ. Bordeaux, ESTIA Institute of Technology
{m.bakni, o.curea. g.terrasson, a.llaria, j.dossantos}@estia.fr

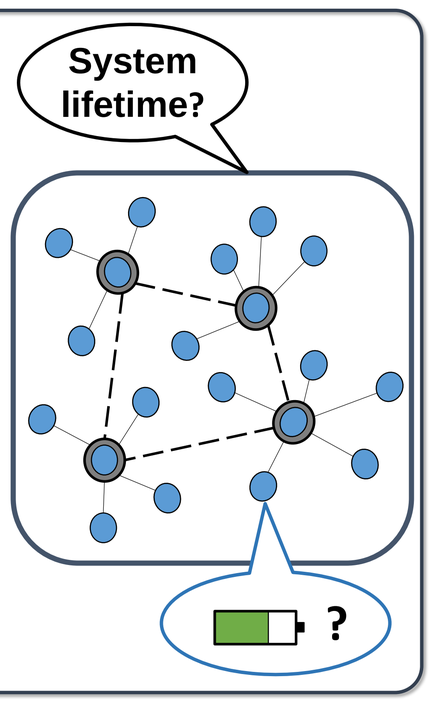
Introduction

Context

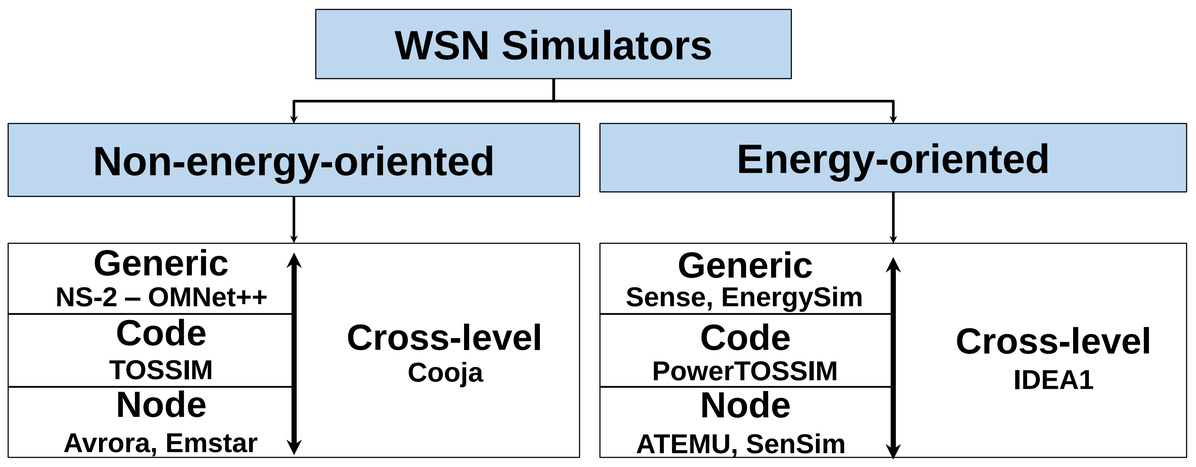
Node autonomy and energy efficiency: key issues in the WSN design

Information required about energy consumption for decision making in the design process

Need of energy model & simulator in this context of power-aware WSN design



WSN simulator classification survey

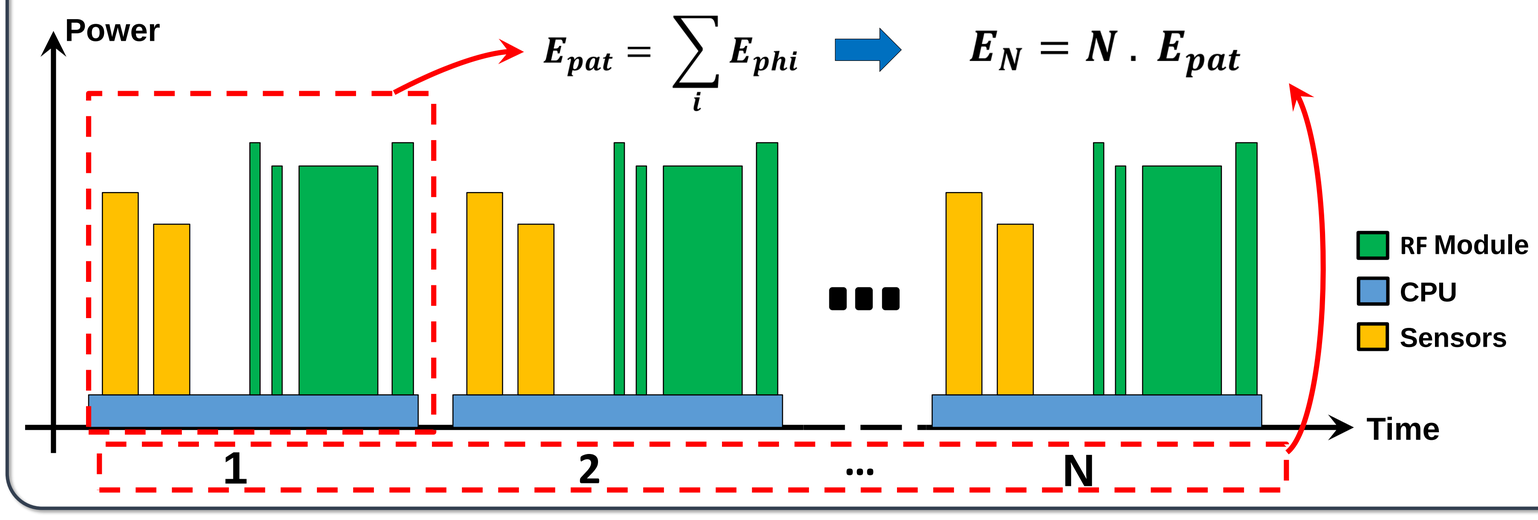


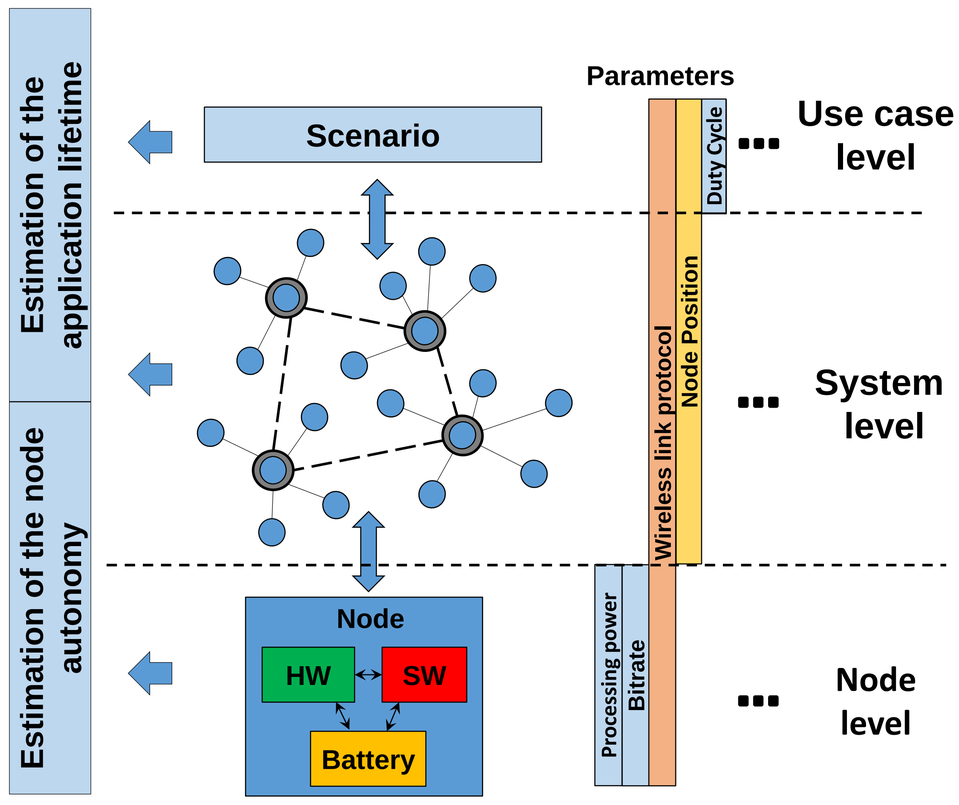
Lack of a model dedicated to estimate energy consumption in WSN from a multi-level point of view

Proposed cross-level energy model

Our approach

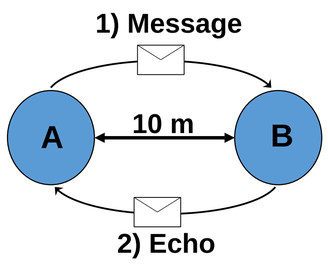
- **Cross-level energy model:** to evaluate several parameters impact at different levels on node energy consumption and network lifetime
- **Pattern-based:** to reduce the overall simulation time → the node energy consumption is considered in an iterative way, defined as pattern
- **Protocol-independent:** to ensure implementations of different wireless link protocols (e.g. 802.11a, 802.15.4 … etc.)





Comparison with an existing energy model

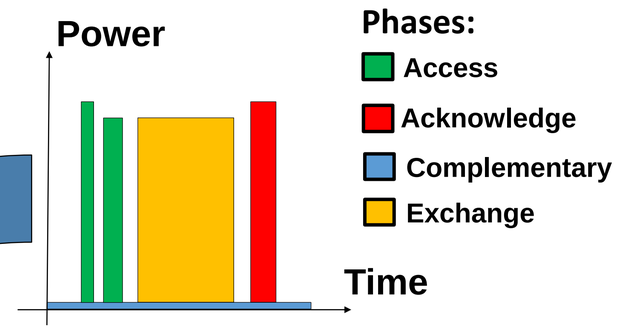
Comparison with NS2 energy model



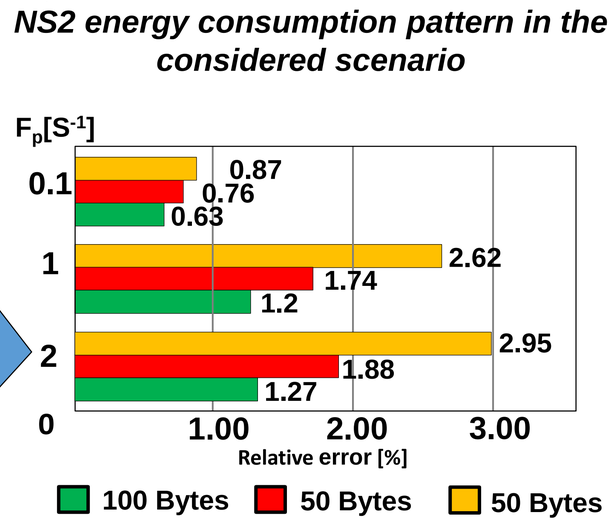
F_P [S^{-1}]	0.1, 1 ,2
Payload [Byte]	10,20 .. 90
Protocol	802.15.4

Model	Payload Size	Consumed Energy (By phase) [µJ]				
		ph_{acc}	ph_{ack}	ph_{exch}	ph_{com}	Total
NS2	10	18.88	39.07	152.8	59.7	270.4
Proposed model	10	18.89	39.07	145.7	59.7	263.4

Phase-based comparison of the energy consumption between the proposed model and NS2 with Fp= $1s^{-1}$



NS2 energy consumption pattern in the considered scenario



Relative error between the proposed model and NS2

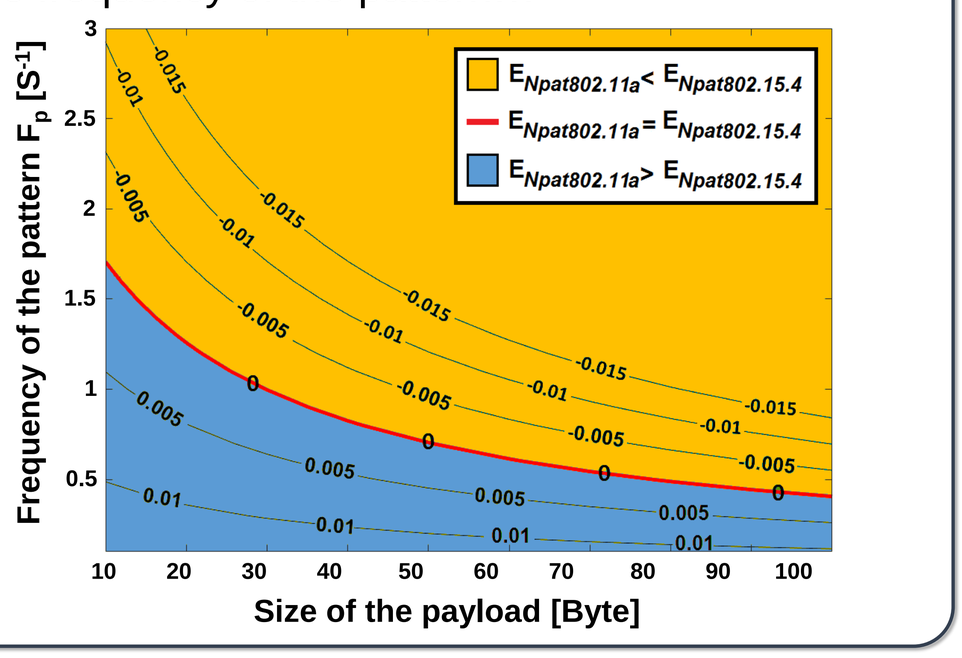
- In this comparison → Only RF energy consumption is considered
- **Relative error < 3%**

Application of the proposed model

Selection of Wireless link protocol

The most suitable wireless link protocol for a given scenario?

Capacity to analyse the impact of different parameters: the size of the payload, the bitrate, the frequency of the pattern…



Future work

- Cross-level energy model implementation of the whole node (HW & SW)
- Proposition of an evaluative pattern concept for specific nodes (cluster head node...)
- Comparison with experimental results to validate the proposed model
- Use this model as a base to design a cross-level simulator

Acknowledgement

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