

*SensorNet-UFAL*  
*LaCCAN::CPMAT::UFAL*

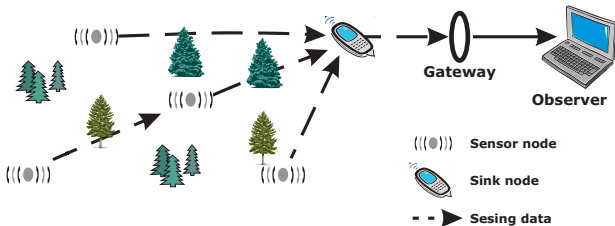
**André Luiz Lins de Aquino**  
alla@ic.ufal.br

3rd Workshop on Modeling and Sensing Environmental Systems

Research group aiming at the development of high level research in Wireless Sensor Networks (WSNs), specifically algorithms for data processing and data reduction

# What is WSN?

- A WSN is a special type of *ad-hoc* network able to perceive the environment
  - Sink, sensor, actuator, and gateway nodes



- Data processing
  - Full data reporting, data aggregation, summarization, data fusion, data reduction, etc
- WSNs applications
  - Rainforest monitoring, air quality, animal tracking, etc

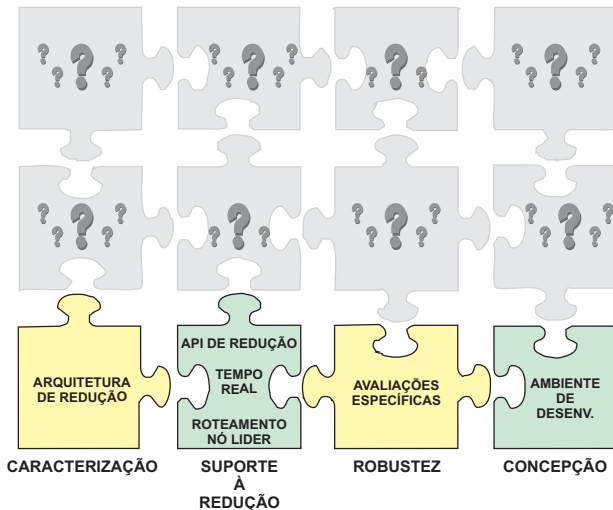
- Premise
  - The emergent necessity to “standardize” the technics and tools used in WSNs.
- Hypothesis
  - The use of a framework allows the prototyping of new applications in WSNs. This prototyping considers the design, analysis, implementation, deployment, and test of general applications in WSNs considering the network infrastructure, hardware, and software aspects.

The “standardization” of WSNs applications that use data reduction technics.

- Some reduction technics
  - Sampling univariate and multivariate
  - Summarization
  - Fusion
  - Compression
  - Aggregation

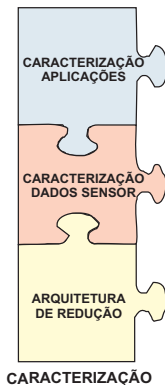
# Data reduction framework for WSNs

- Trying to standardize different solutions



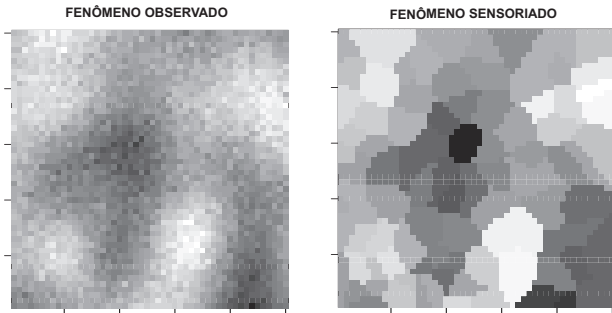
## Challenges research

- Sensing data characterization
  - How to identify the monitored phenomena behavior?
- Application characterization
  - How to characterize different applications in WSNs?



## Some approaches

- Sensing data characterization<sup>1</sup>

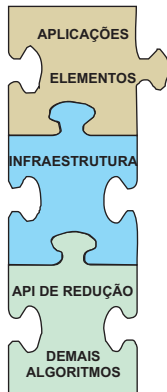


1. Alencar-Neto J. *Estimação de erro em redes de sensores sem fios*. Master student



## Challenges research

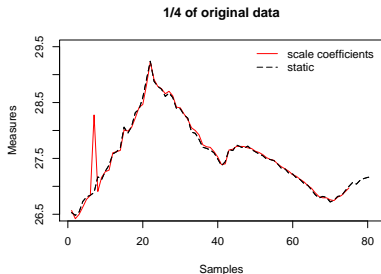
- Reduction algorithms
  - How to increase sampling algorithm efficiency?
- Reduction in specific applications
  - How to use sampling algorithms in real time applications?



SUORTE  
À  
REDUÇÃO

## Some approaches

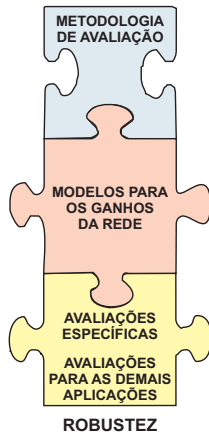
- Data reduction algorithms... Constantly visited...
- A new approach: data reduction based on *wavelets*<sup>1</sup>



### 1. Results published in SAC'10

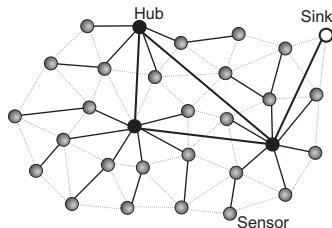
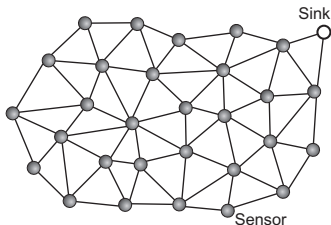
## Challenges research

- Mathematical models to optimize the network infrastructure aspects combined with data sensed
  - How to model multi-objective problems?



## Some approaches

- The use of distributed evolvable algorithms to deploy the nodes considering complex networks design <sup>1</sup>



1. Results published in some conferences – ISSNIP'10 e SBPO'10 – and one journal – IJNCR 2010

## Challenges research

- Development tools
  - How to allow the code generation to sensor nodes?



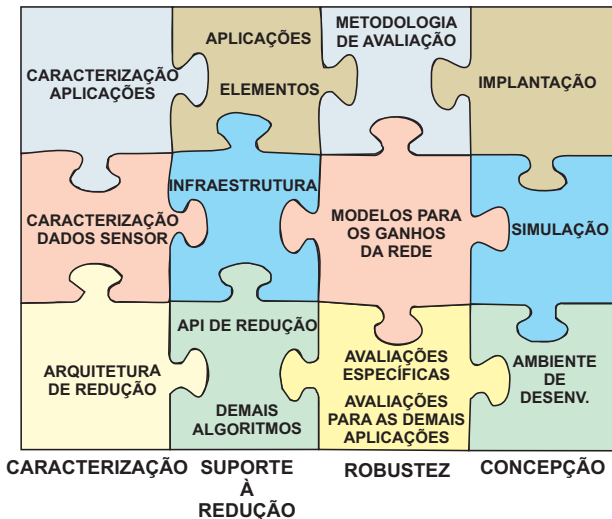
## Some approaches

- Development tools<sup>1</sup>
  - Data visualization based on Android devices

1. Under-graduation projects

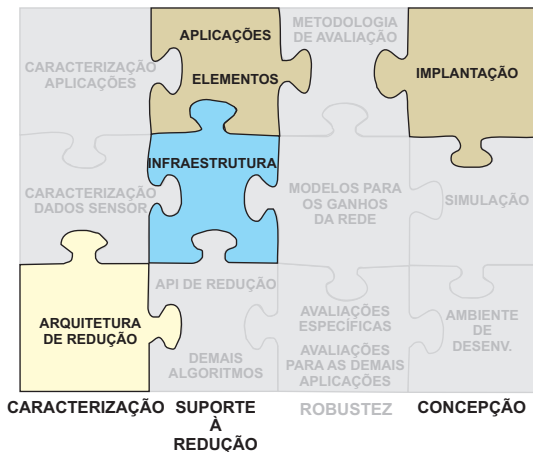
# Data reduction framework for WSNs

- The final framework



# Interdisciplinary aspects

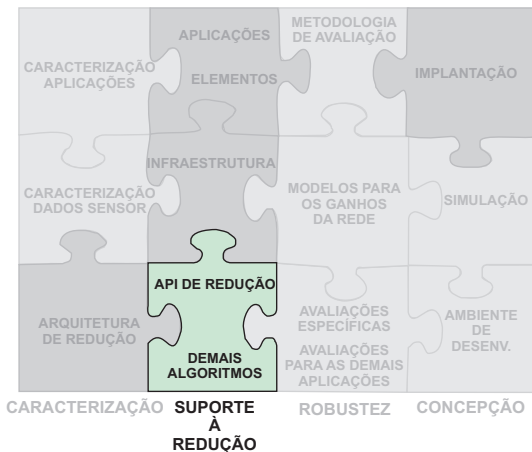
- WSNs: infrastructure, management, and design





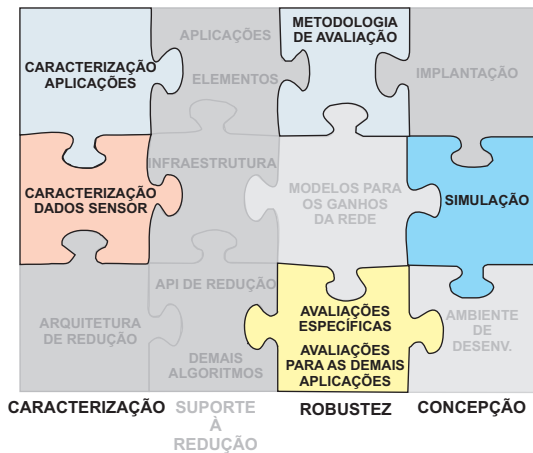
# Interdisciplinary aspects

- Algorithms in hardware and/or software

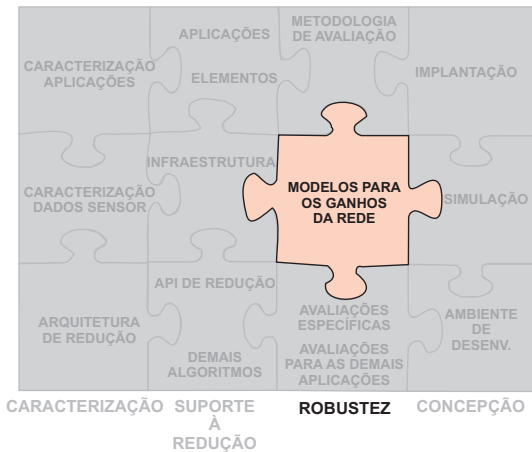


# Interdisciplinary aspects

- Applied statistics, simulation, and modeling



- Optimization



- SensorNet-UFAL
  - Prof. André L. L. Aquino
  
- Collaborators at LaCCAN
  - Prof. Alejandro César Frery Orgambide
  - Profa. Eliana Silva Almeida
  - Prof. Leonardo Pereira Viana
  
- International collaborators
  - Prof. Alexandre Mendes (UoN - Australia)
  - Prof. Osvaldo Anibal Rosso (UBA - Argentina)

- National collaborators

- Prof. Álvaro Rodrigues Pereira Jr. (DECOM - UFOP)
- Prof. Antônio Alfredo Loureiro (DCC - UFMG)
- Prof. Carlos Maurício Figueiredo (FUCAPI - AM)
- Prof. Eduardo Freire Nakamura (FUCAPI/UFAM - AM)
- Prof. Elizabeth Fialho Wanner (DECOM - CEFET/MG)
- Prof. Frederico Gadelha Guimarães (DEE - UFMG)
- Prof. Joubert de Castro Lima (DECOM - UFOP)
- Prof. Martin Gomez Ravetti (DEP - UFMG)
- Prof. Ricardo Augusto Rabelo Oliveira (DECOM - UFOP)

# *Final consideration*

- **The best we have, our students!**
- João Menezes (PhD - UFMG)
- Raquel Cabral (PhD - UFMG)
- Fabiano dos S. Brião (master - UFAL)
- Fabiano S. Conrado (master - UFAL)
- Marcelo Queiroz (master - UFAL)
- Evellyn Cavalcante (master - UFMG)
- André Ruela (master - UFOP)
- Fabrício Valadares (master - UFOP)
- Emanuella T. Lopes (undergraduate - UFAL)
- Fernando Silva (undergraduate - UFAL)
- Guilherme Medeiros (undergraduate - UFAL)
- Israel Vasconcelos (undergraduate - UFAL)
- João V. T. Borges (undergraduate - UFAL)
- Larissa Cavalcante (undergraduate - UFAL)
- Luan B. Cavalcante (undergraduate - UFAL)
- Michael Martins (undergraduate - UFAL)
- Paulo R. S. S. Filho (undergraduate - UFAL)
- Trinny Alarcon (undergraduate - UFAL)
- Victor R. de Oliveira (undergraduate - UFAL)

# Questions?

