Wireless Sensor Networks in Environmental Applications

Marcelo G. Almiron[1] Alejandro C. Frery[1,2]

[1]Centro de Pesquisas em Matemática Computacional (CPMAT)
[2]Laboratorio de Computação Científica e Visualização (LCCV)

Instituto de Computação
Universidade Federal de Alagoas

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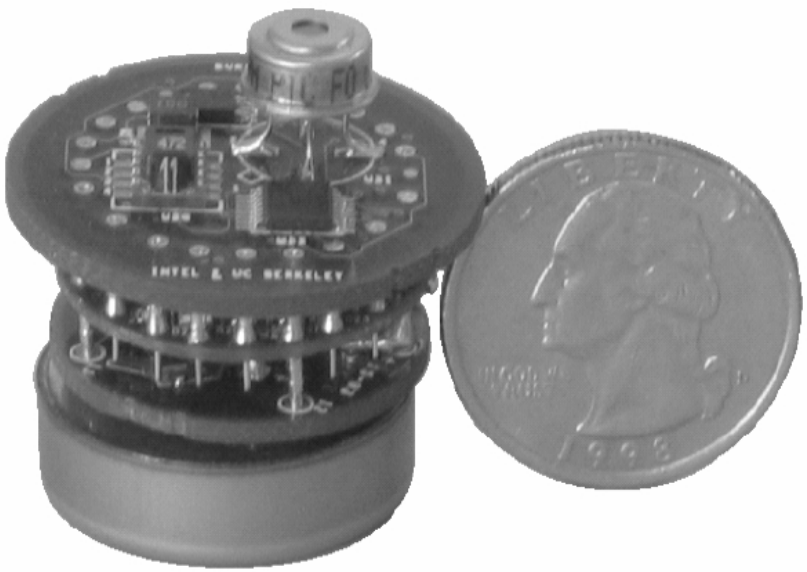

Figure: A sensor node: MICA-2 (by Intel and University of California at Berkeley)

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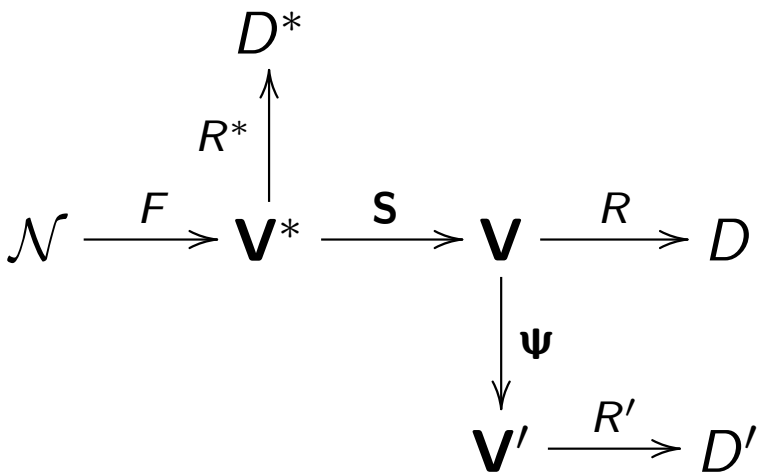

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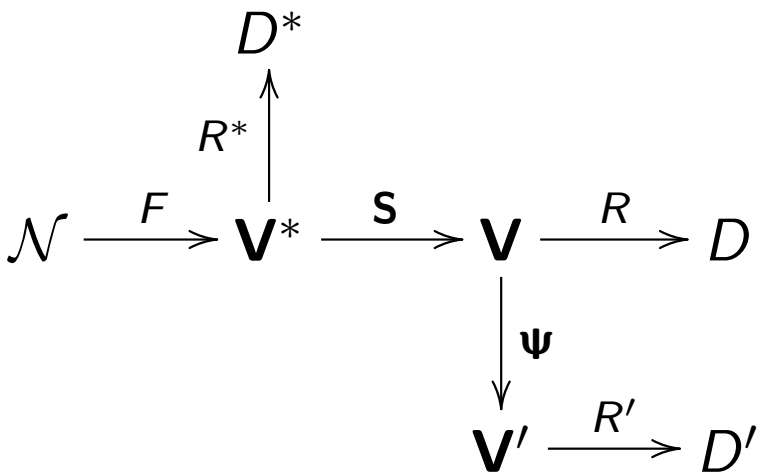

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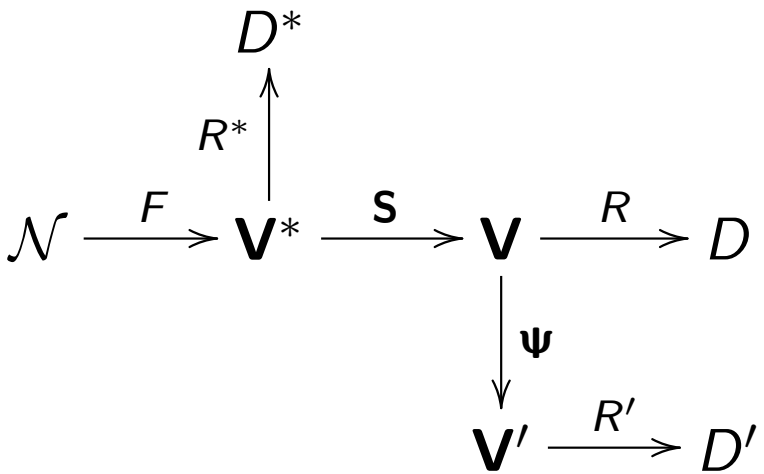

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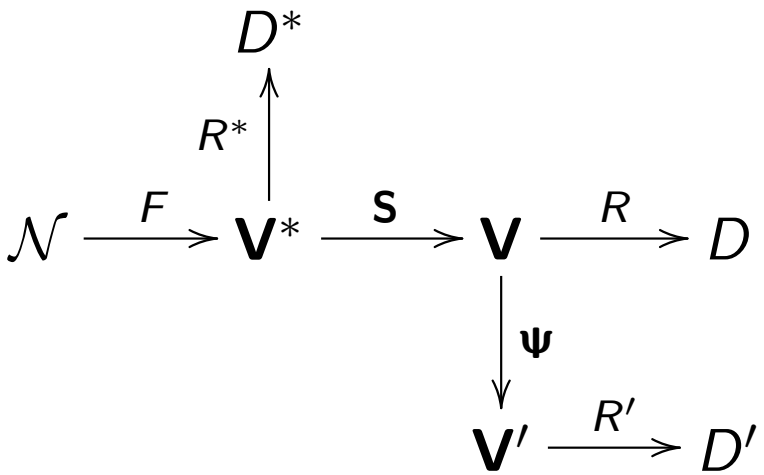

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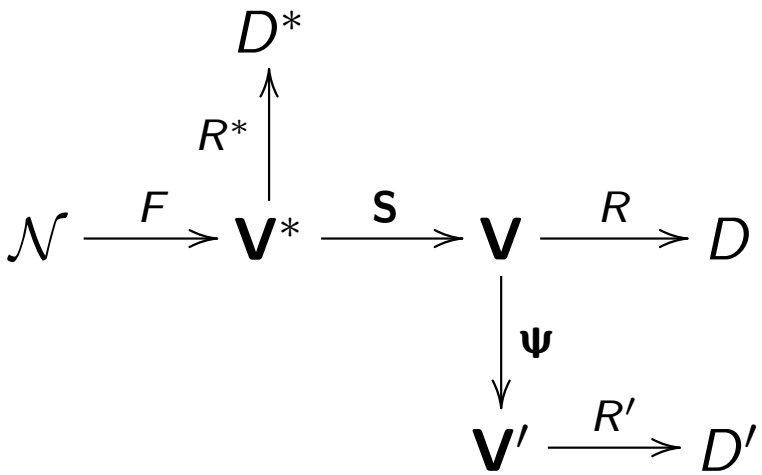

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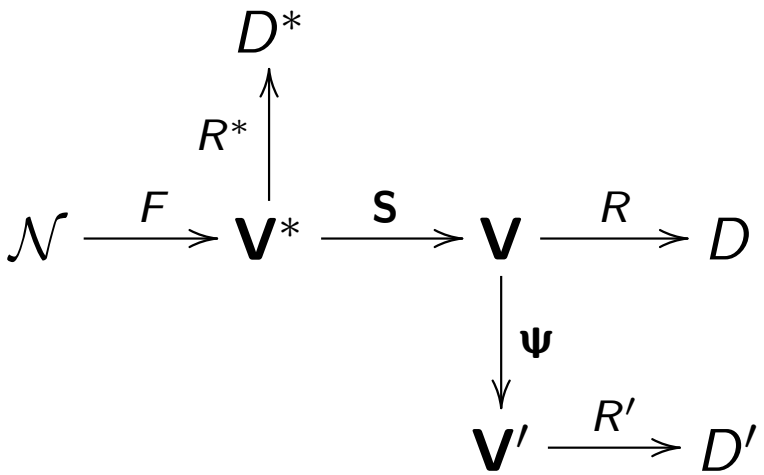

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- $\mathbf{V}'$ represents the case in which we wish to save communication power, the worst in terms of energy consumption, so we apply data reductions ($\mathbf{\Psi}$).

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- Third generation: late 2000s.

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- Life span of hours, days and longer.

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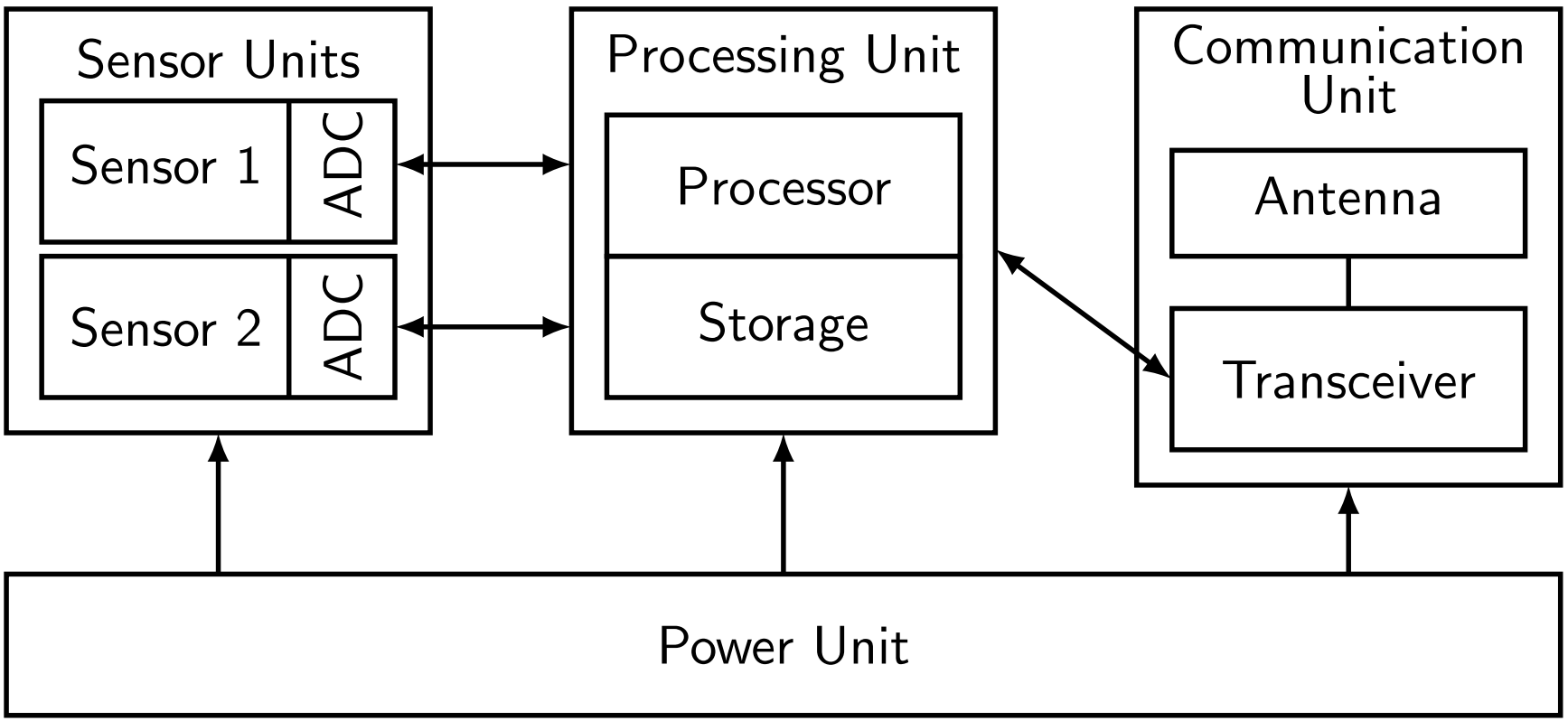
Inner architecture



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- Power consumption can be allocated to three functional domains: sensing, communication, and data processing.

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- This is the unit that puts the heaviest demand on the energy (several orders of magnitude).

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- In each sensing unit we have an associated Analog-to-Digital Converter (ADC).

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8. Process control

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Challenges

Main challenges

They are related to life, connectivity, coverage and scalability.
They are all related, rather than independent issues.

Life time

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2. New hardware/software adaptive solutions for dynamic scenarios

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4. How to dynamically adapt topology in order to grant all essential QoS metrics?

Coverage

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2. How to grant coverage with longest life?

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2. How to grant coverage with longest life?
3. How to turn off irrelevant sensors such that can be turned on when needed?

Application scalability

Main question

How to deploy the smallest (cheapest) possible network that grants all the relevant QoS metrics for the whole expected life, such that it is able to grow and/or to shrink if needed?

The big challenge

What everybody wants

A black box that has as input all requirements and as output every possible detail of the network that meets them with the lowest possible cost.

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- Stochastic models and tools: from low-level modeling to adaptive configuration

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- Data-centric metrics: from energy consumption to expected error
- Multivariate signal reconstruction, Kriging

Research project: RastroAM

Um Sistema de Rastreamento de Espécies da Fauna Amazônica Ameaçadas de Extinção Utilizando Redes de Sensores sem Fio (funded by CNPq)

Project, deployment and use of WSN-based systems for tracking endangered Amazon species

PI: Eduardo Freire Nakamura (FUCAPI, Manaus – AM)

Research staff: Antônio Alfredo Ferreira Loureiro (UFMG), Carlos Maurício S. Figueiredo (FUCAPI), Fabíola Guerra Nakamura & Horácio B. F. de Oliveira (UFAM), Alejandro C. Frery (UFAL)

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Contact

Marcelo G. Almiron

almiron.marcelo@gmail.com
Universidade Federal de Alagoas
http://lattes.cnpq.br/5223281405712895

Alejandro C. Frery

acfrery@pq.cnpq.br
Universidade Federal de Alagoas
http://lattes.cnpq.br/2312365155234431
http://www.researcherid.com/rid/A-8855-2008