



Taking into account Children accurate Weights during Parent Selection process in RPL to extend WSN Lifetime

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A short resume of the presenter

Tiguiane Yélémou received his Master' degree in computer science from Polytechnic University of Bobo-Dioulasso (University Nazi BONI, Burkina Faso) in 2015 and Ph.D degree in design of QoS metrics and routing for wireless network from University of Poitiers (France).

He is currently senior professor at University Nazi BONI.

It research work concern energy and security problematics in sensors network.

Outline

- 1 Introduction
- 2 Context
- 3 Problematic
- 4 our proposal
 - Initial DOGAGS construction
 - Metric design phase
 - DIO propagation
 - Parent selection
- 5 Evaluation
- 6 Conclusion

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Introduction

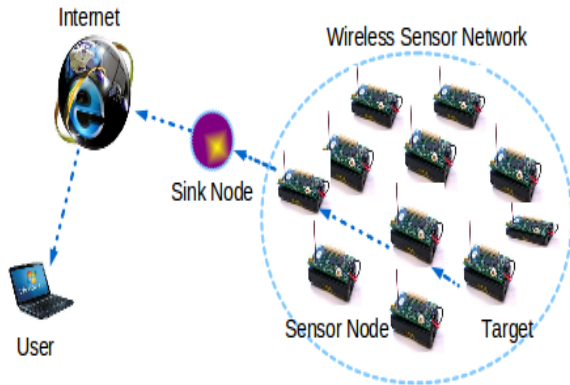


Figure: 1. Architecture of a WSN

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Wireless Sensor Networks:

WSNs fields of applications

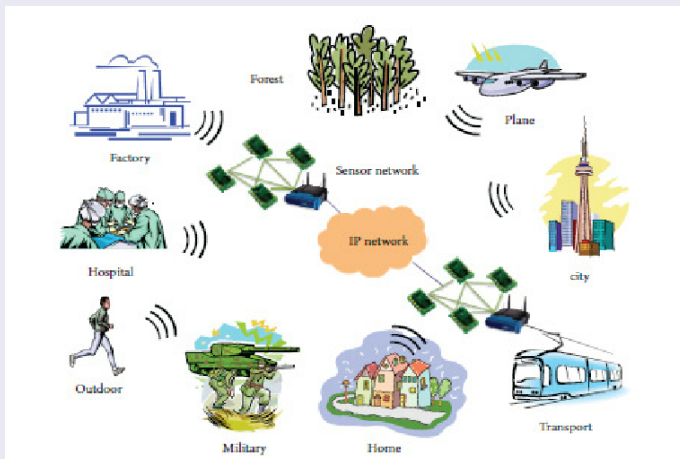


Figure: 2. WSNs fields of applications

Contraintes en ressources:

- CPU;
- range ==> Multi-hop data transmission
- memory;
- Energy;

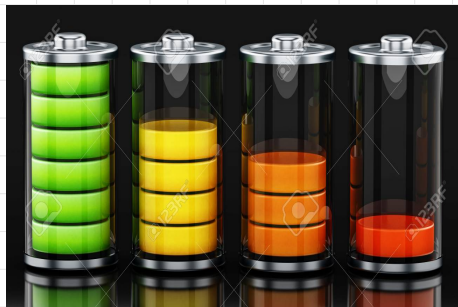


Figure: 3.Energy level

Consequence of energy depletion

- Once battery is discharged, difficult to recharge or replace
- Network connectivity is affected
- Retransmissions, High end-to-end delay

==> Low delivery ratio and data loss

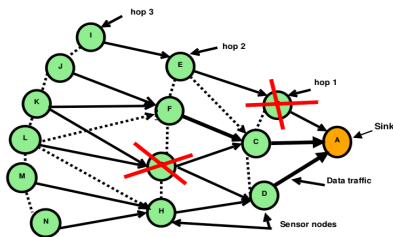


Figure: 4. Network connectivity affected

QoS based approaches (1/2)

QoS based approaches are used to fairly distribution the traffic load amount intermediates nodes.

Different metrics are used for better parents selection:

- Packet Re-transmission Rate (PTR) [18],
- Residual energy [11],
- number of children [7]
- etc.

PTR creates fluctuations.

Flow metric is more complex and does not reflect the total number of flows in a node.

QoS based approaches (2/2)

Ghaleb et al. [7] have designed an objective function to optimize routing load by taking in to account the number of children of potential parent nodes. Their proposed approach is not always efficient. The number of one-hop children does not always reflect the total data load to be passed to the parent.

It is better to take in to account the load since leaf nodes.

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Problematic

- The main drawback of these proposed approaches are that, they do not take into account all upstream children when selecting preferred parents. Then, these proposed approaches lack of method to fairly distribution the traffic load amount parent nodes.
- Most solicited nodes deplete more quickly their energy, that lead to the network partitioning, data packets lost and more re-transmissions;

To address this challenge, in this paper, we present a routing technique based on children weights to fairly distribute children nodes among candidate parent nodes.

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Initial DOGAGS construction

- At the starting of the network : nodes exploit the ETX metric to form DODAGs.

Metric design phase

- Since leaves nodes, Each node evaluates the value of its metric by summing the child metric communicated by its children.

DIO propagation

- if a child node receives DIOs messages from multiple parents, selects the parent with the lowest metric value;
- for each node, a DAO message including its weight is transmitted for the selected parent;
- to avoid fluctuations, a child node can only move to a new parent if the metric value of this parent have two (02) units greater than the old parent;

Parent selection

- upon receipt of DAO message, the parent node sends a DAO-Ack message to the child node if its membership request is accepted.
- Then, the parent node increments the number of its children by the weight of this accepted child;
- To have an updated number of children of each parent, a timer is defined.
- All children that have not transmitted data to the parent node will be removed after the expiration of the timer.
- So the parent node decrement its weight by the weight of disconnected node;
- Each time a node receives a DIO message then restart the process from DIO propagation step.

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Evaluation(1/3)

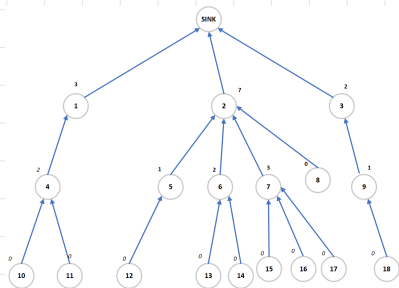


Figure: 5-Network exploiting the ETX metric.

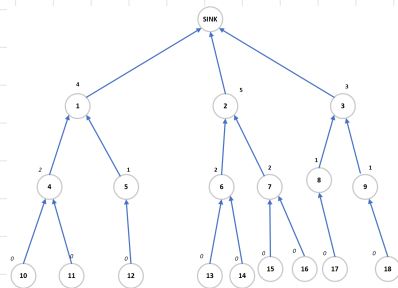


Figure: 6-Network exploiting the number of children metric

Evaluation(2/3)

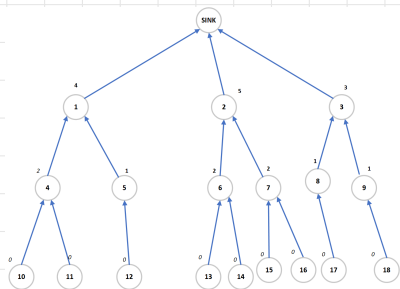


Figure: 6-Network exploiting the number of children metric

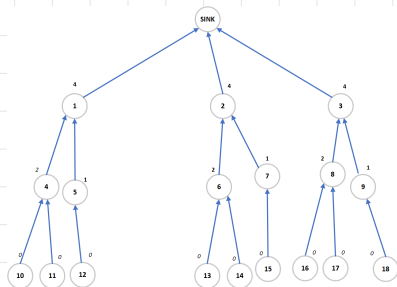


Figure: 7-Network exploiting the total traffic load of each child (in term of number of children including sub children)

Evaluation(3/3)

Table: 1. Load of different nodes according to routing approach

Nodes/Protocols	ETX	Number of children	Node Weight
1	4 α	6 α	6 α
2	11 α	7 α	6 α
3	3 α	5 α	6 α

α is the number of packets generated by each node during the simulation time.

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Conclusion

Contribution

- We first highlighted the shortcomings of works on traffic load optimization in WSNs
- For fairly traffic load distribution, we proposed a Children accurate Weights based approach during Parent Selection process in RPL.
- we performed an analytical evaluation on scenario.
==> **We improve the network lifetime.**

Future work

- we will carry out an exhaustive evaluation with several parameters and embedded tests in various scenarios to confirm these trends and the impact on performance parameters such as PDR, end-to-end delay.

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Thank for your attention!



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