Study of the Scalability on Routing Data in Mobile Network Using the Architecture of Wireless Sensor Network (WSN)

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ABSTRACT: *A few years ago, the applications of WSN were rather interesting than a powerful technology. Nowadays, this technology attracts still more and more scientific audience. This paper proposes a novel case study of routing algorithm for large scale wireless sensor network (WSN) which aims to prolong the network lifetime as long as possible. Our approach focuses on optimizing routing protocol in WSN without losing information on mobile environment and an active notwork. We want also improve the possibility to prolong live-time of node and their energy.*

We will make a study to prove the feasibility of the scalability for our proposed model. When comparing result, we will propose a solution to make ability to this model.

Keywords: WSN, Routing, Algorithm, Optimization, Scalability, Life-time, Mobile

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1. Introduction

Wireless Sensor Networks(WSNs) (Figure 1) [2] consist of a large number of autonomous nodes equipped with sensing capabilities, wireless communication interfaces, and limited processing and energy resources. WSNs are used for distributed and cooperative sensing of physical phenomena and events of interests, such as environmental monitoring, habitat monitoring, prediction and detection of natural calamities, medical monitoring, and structural health monitoring.

Usually, the node can also be mobile and can be able to interact with the other node of the network.

WSN have found application (Figure 2) in a vast range of different domains, scenarios and disciplines [15]:

1) **Environmental/Earth monitoring:** The term Environmental Sensor Networks, has evolved to cover many applications of

WSNs to earth science research. This includes sensing volcanoes, oceans, glaciers, forests, etc.

2) **Data logging:** Wireless sensor networks are also used for the collection of data for monitoring of environmental information; this can be as simple as the monitoring of the temperature in a fridge to the level of water in overflow tanks in nuclear power plants. The statistical information can then be used to show how systems have been working. The advantage of WSNs over conventional loggers is the "*live*" data feed that is possible.

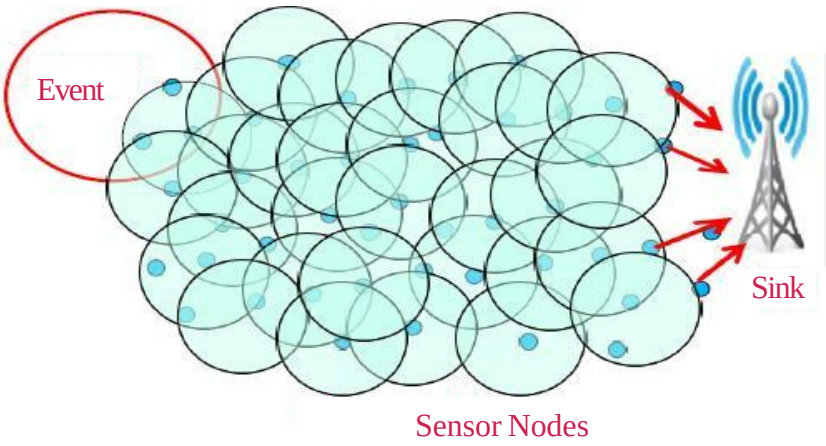


Figure 1. WSN Architecture

3) **Agriculture:** Using wireless sensor networks within the agricultural industry are increasingly common; using a wireless network frees the farmer from the maintenance of wiring in a difficult environment. Gravity feed water systems can be monitored using pressure transmitters to monitor water tank levels, pumps can be controlled using wireless I/O devices and water use can be measured and wirelessly transmitted back to a central control for billing.

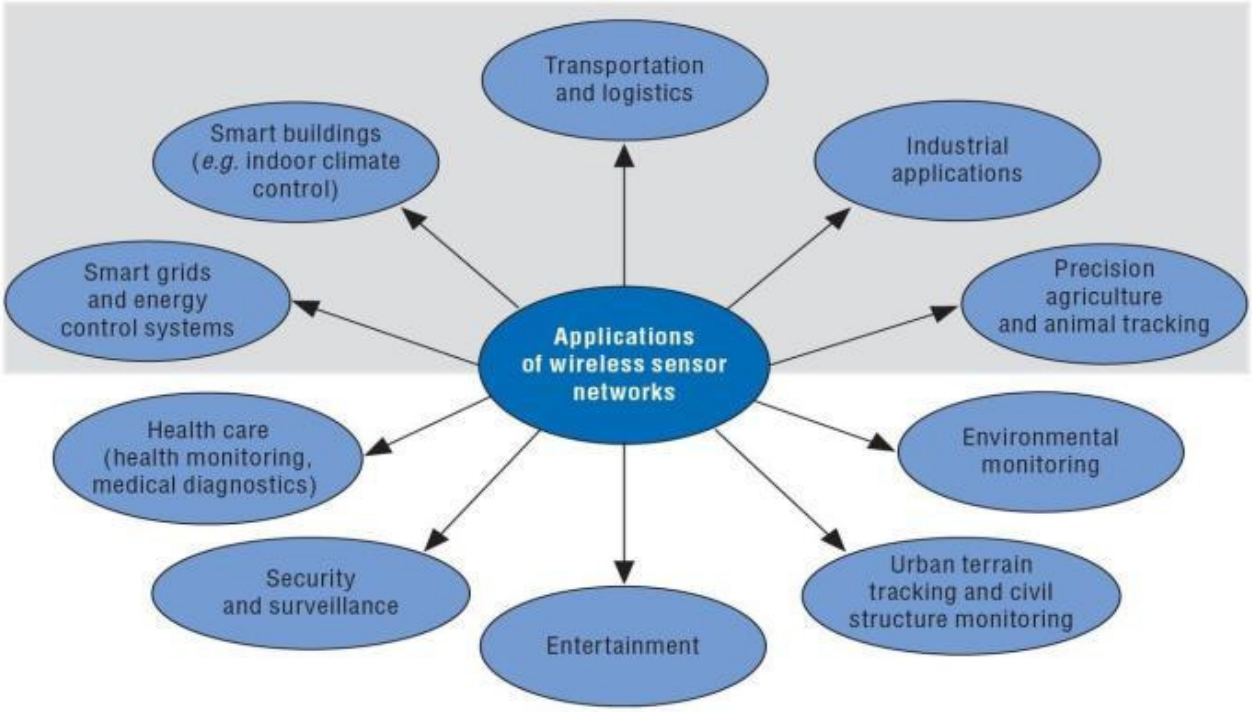


Figure 2. [16-17-18]: WSN application

1.1 An Ad Hoc Network Routing Protocol

Many routing protocols have been proposed to optimize the efficiency of WSNs amidst of above mentioned severe resource constraints.

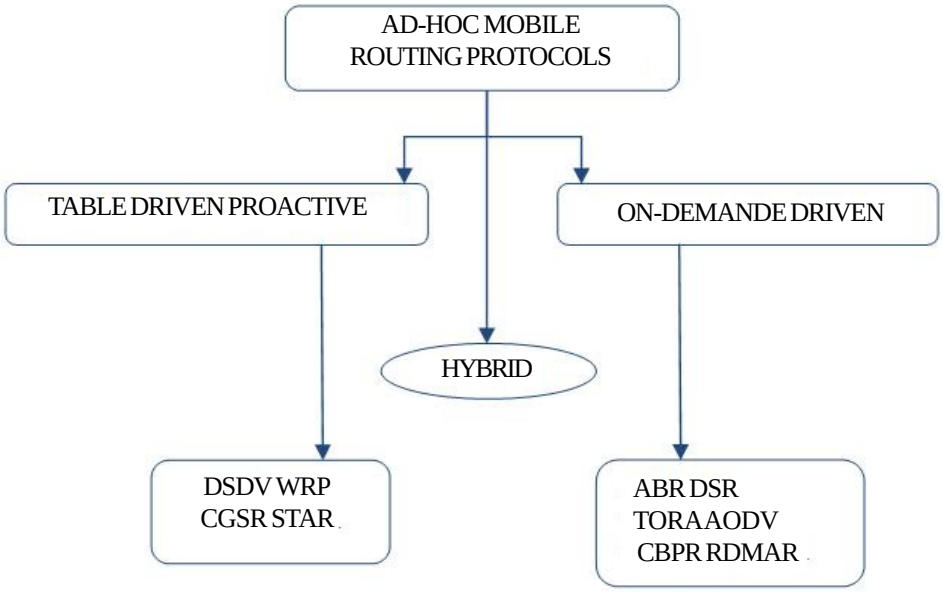


Figure 3. Ad-hoc Mobile Routing Protocols [14]

An ad hoc routing Protocol (Figure 3) is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad hoc network .

1.1.1 Proactive Routing [8-9]

These protocols are also called as Table-Driven routing protocols since they maintain the routing information even before it is needed [6]. Each and every node in the network maintains routing information to every other node in the network. There exist some differences between the protocols that come under this category depending on the routing information being updated in each routing table.

1.1.2 Re-active Routing [8-9]

These protocols are also called On Demand routing protocols (since they don't maintain routing information or routing activity at the network nodes if there is no communication). AODV [10] is also appropriate for working in restrictive environments. It has the ability to intercommunicate with the endpoints which cannot be accessed directly.

We present a brief comparison between those protocols on the following table:

The key challenges faced at different layers of MANET are shown in Figure 4.

In this figure, we represent the layered structure and approach to ad hoc networks. The important layers of our ISO/OSI model are:

- **Physical/Link Layer**;

- **Network Layer:** The most important and interesting question is how one node finds a multi-hop path to the other node. Routing protocols for mobile ad hoc networks are divided into three large classes proactive, reactive and hybrid routing protocols as presented in Figure 3;

- **Transport Layer:** In most ad hoc networks various realizations of TCP are used as the transport protocol;

- **Application Layer:** Unlike the Application Layer in common networks, application layer in mobile ad hoc networks can't be completely isolated from the network layer.

Our study is focused in Network Layer.

Protocol	Proactive	Reactive
Advantages	A route can be selected immediately without delay	Lower bandwidth is used for maintaining routing tables. More energy-efficient Effective route maintenance
Disadvantages	Produces more control traffic Takes a lot more bandwidth Produces network congestion	Have higher latencies when it comes to route discovery

Table 1. Comparison Between Proactive and Reactive Routing Protocols

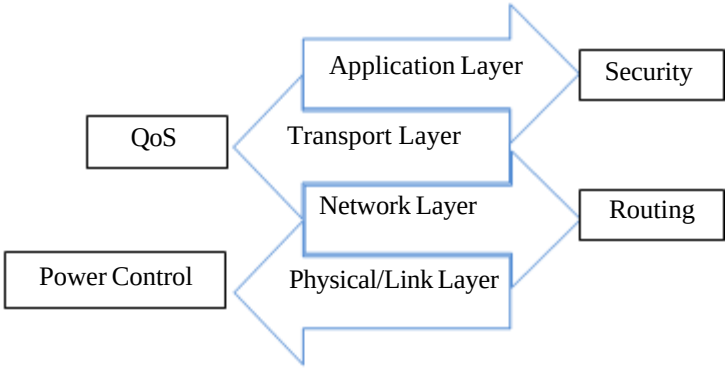


Figure 4. MANET Challenges

2. Related Work

In [11], they present a survey of different routing protocol. Protocols described in this paper reveal the influence of underlying network structure on the routing protocols and they also show how the routing strategy differs in various design considerations. In this paper, they proof that the one of the popular on-demand schemes, AODV, scale well for large networks when communication pattern is sparse and mobility is low.

In [12], auteur presents a new, simple and bandwidth-efficient distributed routing protocol to support mobile computing in a conference size ad-hoc mobile network environment.

In [13], it describes the characteristics of Mobile Ad hoc Networks (MANETs), and their idiosyncrasies with respect to traditional, hardwired packet networks, and their effect on the design of network control protocols.

3. Proposal Model

The main interest of the project was to test the ability of routing protocols to react on network topology changes (for instance link breaks, node movement, and so on). Furthermore the focus was set on different network sizes on varying number of nodes.

In our model, we represent how we reply to a transmitted data following the model:

3.1 Client

- The client sends his request in broadcast mode in network, and waits an ACK from the close node following its routing table.

- If after time (few second) the client does not receive an ACK, it returns its request.

- The client receives the ACK from his neighbors and waits the response to his request.

- The client receives the response; and register in its memory for a possible use.

- The client updates (MAJ) his routing table.

3.2 Server

- The close nodes intercept the received message and determine the client node.

- They send their ACK with the transmitted node and treat the request.

- If the answer of the request is in only one node, it MAJ its routing table, try to find the nodes close with the client node, and allow to transfer information within an optimal time.

- If the answer of the request is on several nodes, we make a cluster (manually).

4. Model of Simulation in NS-2

Our simulation was carried out in the following software environment:

- Operating system UNIX: Ubuntu
- The simulator: NS2

4.1 Simulation Environment and Scenario

Our simulation is based on the Network Simulation NS-2.34. Simulation helps in analyzing the performance and behavior of complex networks before implementing it in real application. The goal of our experiments is to examine and quantify the effects of varying the number of node and their interactions of ad hoc networks.

4.2 Results of the simulation

In this work the performance analysis is carried out in an ad-hoc network by varying two parameters: number of nodes and node interactions. We kept the other parameters constant.

The rest of the simulations parameters are represented in table 2:

Number of Nodes	10 20 30 40 100
Network Type	Mobile/ Static
Connection Type	UDP/CBR
Packet Size	1000 bytes
Routing Protocol	AODV
Radio-Propagation Model	TwoRayGround
Interface Queue Type	DropTail
MAC Type	Mac/802_11
Antenna Model	Antenna/OmniAntenna
Link Layer Type	LL
Chanel Type	WirelessChannel
Max Packet in ifq	50
Zone of Deployment	(1800, 840) / Variable

Table 2. The Simulation Parameters

We use to choose a big data (1000 bytes) to see how the node can work.

In the first time, we represent the information about the packet size, on a network with 10 nodes "*static and mobile*". (Figure 5)

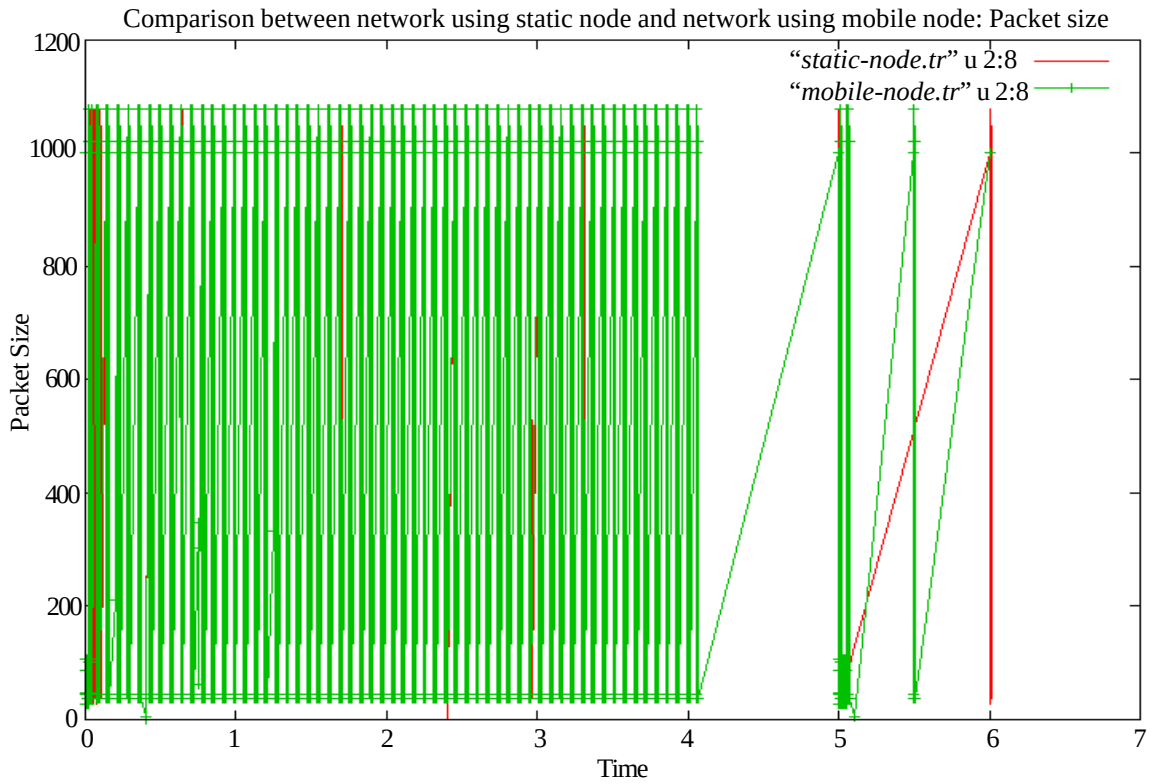


Figure 5. Comparison between routing data

In the first case, we used static node. We conclude that the size packet don't change in the two cases. It means, we don't have any interferences or data loss using WSN with few nodes.

In the second case, we use mobile and static node. We can see on the graphic colored on green (in Figure 5) that there is no difference between the two graphic and have the same observation.

So to study the feasibility of our new model using the mobile node, we will increase the number node (mobile node) from 10 to 100 nodes on the network in order to simulate a real case. We will begin with the case using mobile node.

When we increased number of mobile node in the network, we can conclude those results of simulation. Those graphics represent the non coherence on the size of the packet, because we use a big data.

In order to resolve this problem, we will include the clustering method to have an ability to change number node (+ or –) without any problem on the packet size and have the possibility to exchange data easily.

5. Conclusion

Routing is a significant issue in Wireless Sensor Networks. In the presented work, we have discussed a scalability on routing data in WSN with different simulation times and interactions for our model, because it is the most important factor to prove the goodness of the routing model and how it can be adaptive to the changes in the network topology .

The scalability is more challenging in the presence of both large numbers and mobility. If nodes are stationary, the large

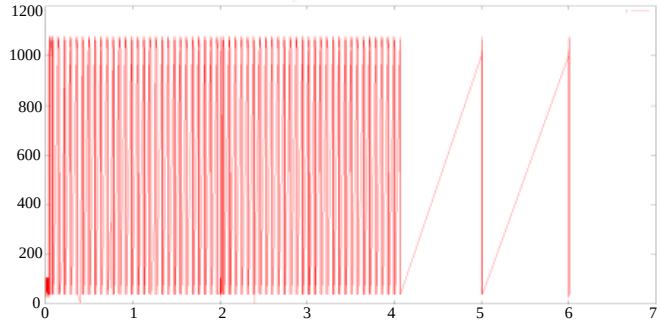
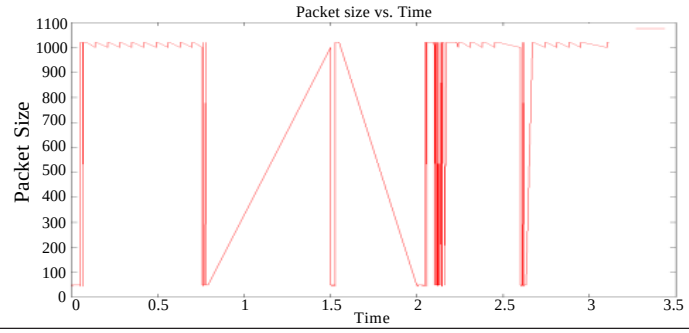
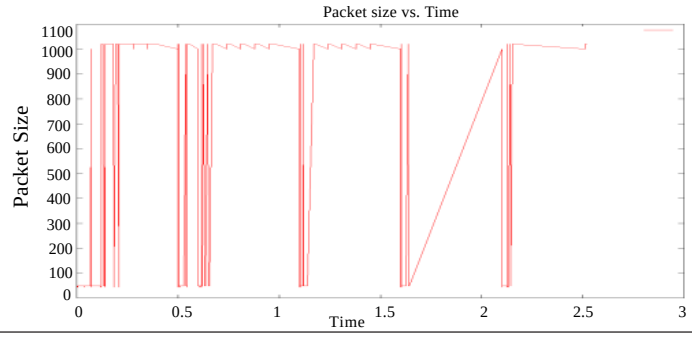
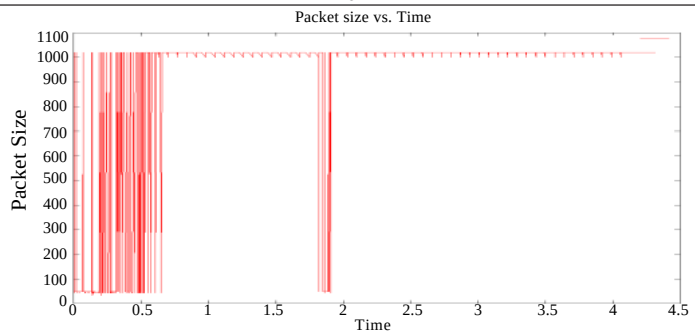
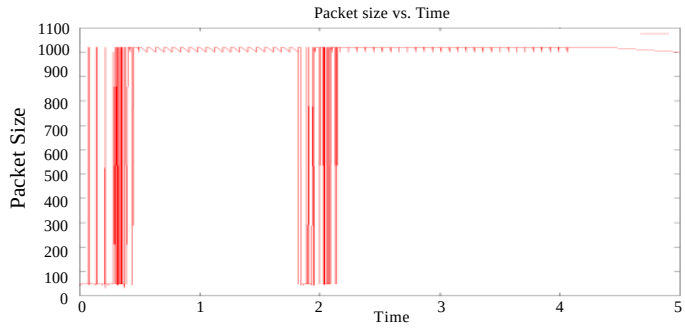
Number Node	Result of simulation
10	
20	
30	
50	
100	

Figure 6. Simulation of Real Case

population can be effectively handled with conventional hierarchical routing. In contrast, when nodes move, the hierarchical partitioning must be continuously updated. The next contribution will be the resolution of the incoherent problem for the packet size, the large scale of nodes and also the mobility of the node. For that, we will use the new approach of clustering in WSN adapted of our case.

We sincerely hope that our work will contribute in providing further research directions in the area of routing.

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