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A Study of Energy Model in WSN Routing Using OMNETPP

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Abstract

In recent trends, Energy conservation is the important factors in the implementation of routing protocols in the wireless networks and mobile ad-hoc networks.. The major routing protocols categories are reactive and proactive methodologies. In any of this method, sending request, connecting to network, path discovery, connecting to the base station, sending request all operations should be made energy aware. This paper focuses mainly the flooding routing protocol and implements the new framework methodology to that protocol to reduce the network traffic and packet loses. The proposed work analyzes packet broadcasting to all nodes for identifying the shortest path. Our system increases the energy level when maximum packets are transferred in more number of nodes increasing and produces the optimized result. The whole study is in the OMNETPP – MIXIM platform.

Keywords: Energy-efficiency, flooding, routing, OMNETPP, MIXIM

1. INTRODUCTION

Flooding is the vastly used routing algorithm. In flooding, a node sends a packet that received, to all its neighbors other than the neighbor which send the packet to it, if the packet is not intended to itself or the maximum number of hops a packet can pass is not crossed. Flooding is very simple to execute, and it is reactive protocol, as it does not maintain any routing table (topology maintenance) and does not require discovering any routes. But this method has several disadvantages, the most vital being, it is responsible for large bandwidth consumption and it wastes valuable energy [1]. Most of the recent studies in wireless communications brought out the fact that the studies of routing in WSN are based on the more theoretical model than the realistic model. So, the energy accuracy and packet losses are not more realistic. Reliable routing is considered for the routing mechanism with the path aware matrices. Here the focus is on the at any cast, destination should get the data packet in a time interval. It doesn't consider about the energy efficiency in the overall operations. The optimal routing algorithms only consider and decide on the shortest path and shortest time interval; it doesn't bother about the energy involved in optimization operation. This paper will discuss mainly on how the **communication model** elements like channel, routing table, node forwarding, channel manager, receivers, and transmitter in OMNETTP MIXIM framework support the energy efficiency in routing. In addition it will highlight how the **reliable and optimal routing operations** can be made energy efficient with the help of the simulation platform OMNETPP MIXIM. The routing scenario considered in WSN here is the many to many one.

2. FLOODING ROUTING ALGORITHM BASICS

Flooding is based on the data diffusion. It is the data centric reactive routing technique, in which the routing matrix and the data value pair and the reinforcement of the path. When a node known as a sink node wants information about a meticulous attribute, it broadcast interest messages to its neighbors. These interest messages are flooding throughout the network and are added to each node's interest cache [2]. Each interest record in this cache has one or more gradients which correspond to neighbor nodes that transmitted the interest [3]. The sink node may reinforce the shortest path (i.e., the one with the fastest response) by sending an interest with a higher data rate along that path. Intermediate nodes broadcast the reinforcement by examining a local cache of recently sent data messages. The data cache also avoids loops in data delivery.

2.1 Flooding in OMNETPP

A simple flooding protocol is for network-level broadcast. This execution uses plain flooding, i.e. it "remembers" (stores) already broadcasted messages in a list and does not rebroadcast them again, if it gets an additional copy of that message. The greatest number of entries for that list can be defined in the .ini file (@ref bcMaxEntries) as well as the time after which an entry is deleted (@ref bcDelTime)[4].

```
simple Flood extends BaseNetwLayer
{
    parameters:
        bool plainFlooding = default(true); // flag whether to use plain
flooding
        // Max number of entries in the list of already broadcasted
messages
        double bcMaxEntries = default(100);
        // Time after which an entry for an already broadcasted msg can
be deleted
        double bcDelTime @unit(s) = default(100 s);
 double defaultTtl = default(10); // Default time-to-live (ttl) used for
                this module expressed in  number of hops.
        @display("i=block/fork");
        @class(Flood);

}
```

Figure 1 Flooding implementation in OMNETPP

2.2 Energy Issue in Flooding

When the flooding uses the broadcast mechanism to propagate the messages into the nodes and the destined node takes it if the interest or addresses matches. Here the reliable delivery is only considered where as the issues of overhearing that are the nodes which are not destined to receive the nodes also receive it and the multi-hop transmission for the single data packet passes through multiple nodes to reach its destination is not addressed.

In OMNET by the time, message synchronization algorithms the issue of energy is addressed. The portable and configurable algorithms are the best part with OMNETPP for any researcher and help them to focus only on the research issues.

2.3 Modules and Algorithms for the Control of Energy Issue in Flooding

2.3.1 Flooding Nodes:

The broadcast authority or the privilege is given only for the hierarchy node or the cluster node, not for all the nodes. In OMNETPP the virtual clusters can be defined and data passage can be limited only through that nodes.

2.3.2 Propagation in Batch

The nodes don't respond immediately on the data packets; rather it passes them after aggregation.

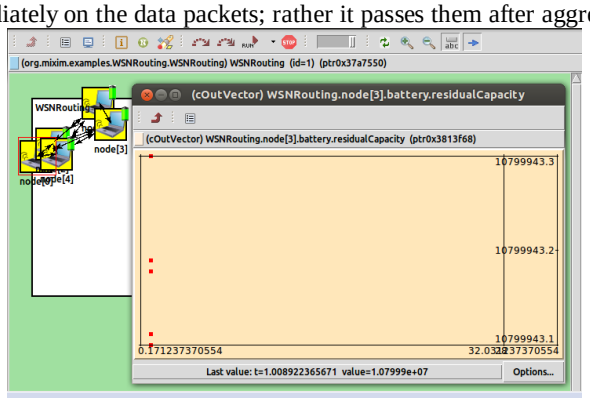

Figure 2 WSN Routing With Residual Energy Study Using OMNETPP

2.3.3 Synchronization

The time schedules are decided based on the synchronization algorithm which not only decides the time schedules but also stamps the packets with the time, destined node details to avoid the duplication propagation.

3. COMMUNICATION MODELS OF OMNETPP

The communication models are the master classes with the properties and methods with which the whole routing process happens through. The platform OMNETPP provides some of the basic models like channel, channel manager, receiver, and transmitter so that it can be directly referred in the NED (Network Description Language) and can be used for the WSN operations like routing, aggregation. But, one step further, the frameworks like MIXIM, INET, INETMANET, CASTALIA, CHSIM all has the compound models which are wrappers over the base classes and takes care of multiple high level operations. The best part is most of them are available as the configurable features so that anyone can customize the operation (here the case is ROUTING) as per their need.

3.3 OMNETPP Communication Models

3.3.1 Message

This is the data structure can extend into grater complexity. It is used as the box to contain the data to be propagated to the destined node. This message can contain the relative or the actual address of the destined to node to which it has to be delivered.

3.3.2 Gates

This is the interface used for the input and output. Input gate is the model through which the data arrive into any model where as the output gates are ones through which the data goes out of any model.

3.3.3 Link

It is the association created between the gates of the sub modules of a compound model. It can be used to pass the data through that link.

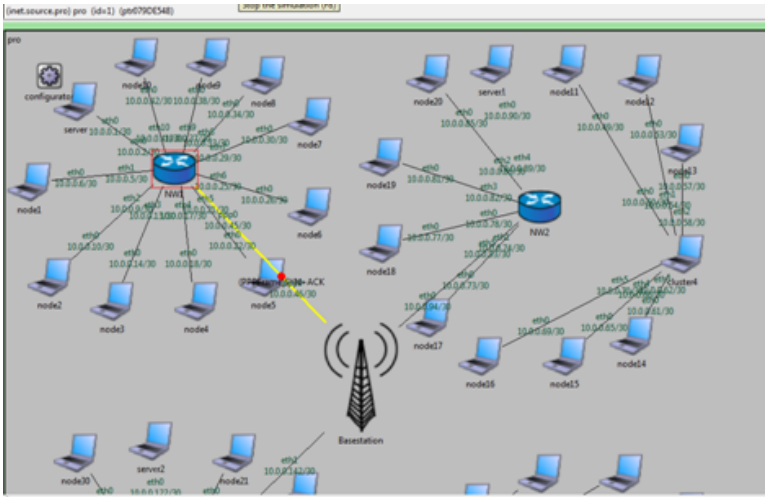

Figure 3 Simple Communication Modules of OMNETPP to support Routing

3.3.4 Channel

It defines the connection type where we can define the delay parameters for the data transfer through those connections. OMNeT++ 4 supports two way connections, First of all, we have to define two-way (or so called `inout`) gates instead of the separate `input` and `output` gates. Channel can be parameterized with the following details, bit rate, data rate, and propagation delay. The channels are not limited only with the parameters but also encapsulate the simple algorithms like queue and routing.

3.4 Framework Supported Communication Models

3.4.1 Routing Table

The routing table has the routing matrices relevant to the host (it could be node or router). Every module dynamically adds the entry relevant to route of that entity. The table is read by the routing table parser. The settings and configurations can be overwritten dynamically. The routing table objects are read only by the protocol implementations like OSPF. The routing table is the list of IPRoutes objects.

3.4.2 Notification Board

The Routing Alarms **API** provides advanced notification functionality, which allows for the observing of large scale networks. Configuring Routing Alarms can be made through the user interface or through the import router configuration tool.

Network and operations managers rely on Routing Alarms to ensure smooth, continuous operation of their Internet-based communications. The real-time sensor grid incessantly monitors, collects, analyzes and correlates Internet routing data from hundreds of vantage points globally to provide the most comprehensive view of the Internet[5]. In addition, our highly developed analytics and historical database minimizes false positives, and speed-up problem resolution.

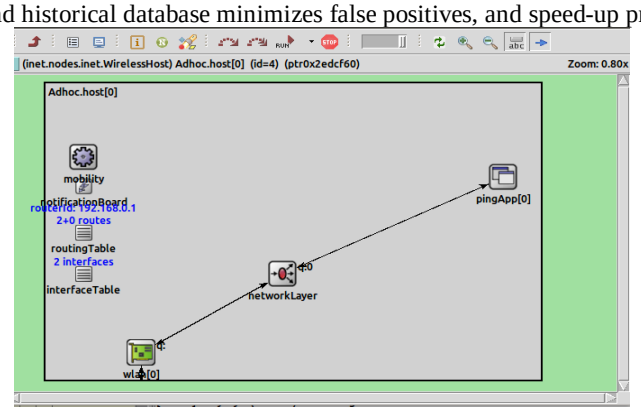

Figure 4 Compound Communication Models Supported by OMNET framework

3.4.3 Blackboard

The Purpose of the Blackboard Service is the management of SIMULATION record data during processing in a SIMULATION component (Connectivity, Workflow Processor). The use of the Blackboard service is not restricted to workflow processing, although it can be also used in Connectivity to create the initial SIMULATION record from the data sent by Crawlers. This way the determination services are hidden from connectivity also[6].

It is assumed that the workflow engine itself (which will be a third party product usually) must be embedded into SIMULATION using some wrapper that translates incoming calls to workflow specific objects and service invocations from the workflow into real SIMULATION service calls.

4. ROUTING MECHANISMS OF OMNETPP

The routing as a process involves lot of sub activities which is totally considered as part of the routing mechanism or the routing algorithm [7]. The sub activities are how the nodes are formed and placed for the simulation – it is not only physical arrangement of topology but also the logical arrangements of their communication (the clusters), the path discovery, sending the request, transmitting data, sending acknowledgement, connecting to the base station.

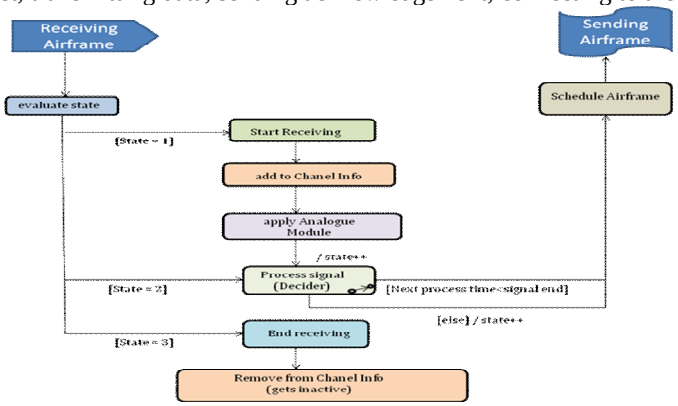

Figure 5 Synchronized Scheduling in Data Transmission Supported in OMNETPP

4.1 Node Formation

It is the logical arrangements of nodes to confirm the nodes communication pattern. The cluster mechanism tells the nodes the purpose for the cluster formation [8]. The network coding can tell them how the information is to be propagated than on the logical arrangements of nodes. Here the cluster formation, cluster head election, cluster head rotation, load distribution are the activities to be supported by the simulation medium to implement the routing.

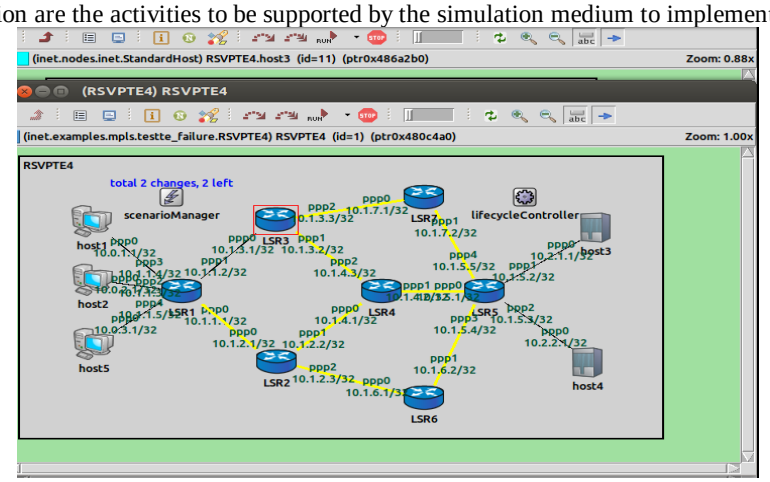

Figure 6 Node Formations in Routing with OMNETPP

4.2 Path Discovery

It is the mechanism in which the nodes identify the route information. The decision of the route is based on the interest cache and the history of the routes already decided. The broken link identified will alter the path based on the already existing information. Active ratio and the non dead route – active route is to be identified dynamically[9]. The runtime scan is to be scheduled to keep track of the paths status. OMNETPP supports the node specific history maintenance in routing table and the simulation specific across layer porting details in blackboard, the interface links are maintained in the interface table. To investigate any simulation, you can take the snapshot and analyze the results.

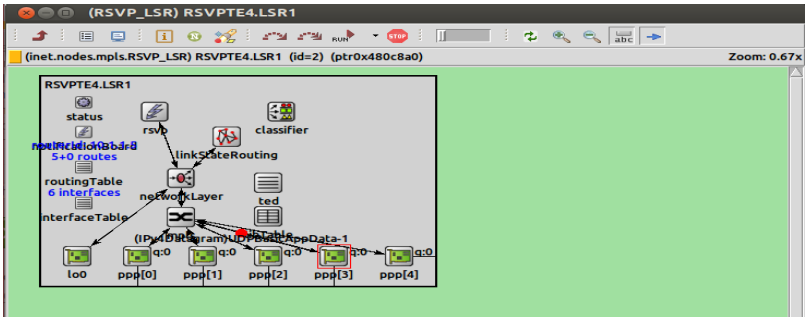

Figure 7 Path Discovery Activity Support in OMNETPP

4.3 Transmission and Acknowledgement of Data

The transmission of the data has to consider multiple facts. The collision of data packets and retransmission, the reliable transmission needs the algorithmic implementations [10]. This algorithm needs the consideration of energy along with the reliability.

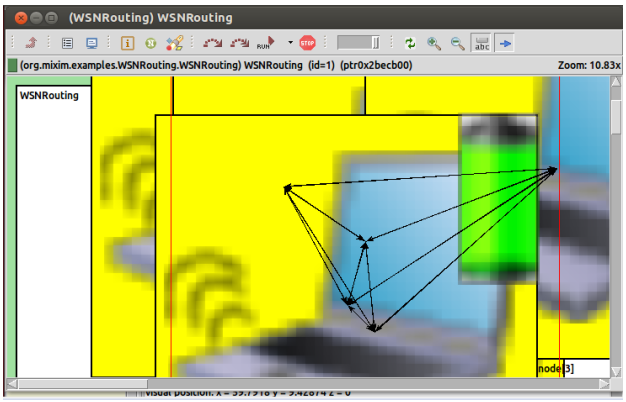

Figure 8 Routing with Energy Study in WSN routing

5. CONCLUSION AND FUTURE WORK

The paper focuses on the routing algorithm flooding implementation in OMNETPP with the energy model study. The routing as a process involve many activities like node formation with physical and logical groupings (topology, clusters) , path discovery, maintaining routing table, across layer data passage in the notice board recording to keep the active path and the life ratio are discussed in detail with the energy model study using the OMNETPP. The porting of any particular activity or mechanism in a module needs the code change in OMNETPP. It lacks the usability and technical expertise in coding. As OMNETPP provide the application wise or process wise usability, it should get extended to the activity wise configuration. Developing routing controls with the activity granularity in the design by considering the energy will be the future direction of the research. So that, any process wise or activity wise changes will have internal energy integrity check.

References

[1] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, “Wireless sensor networks: a survey,” Comp. Netw., pp. 393–422, 2002.

[2] Geetika Dhand, Dr.S.S.Tyagi, “Survey on Data-Centric protocols of WSN”, International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 2, Issue 2, February 2013.

[3] K.E.Kannammal, Dr.T.Purusothaman, “Evaluation of Directed Diffusion Protocol for Mobile Sensor Networks”, International Journal of Engineering Science and Technology, Vol. 2(6), pp. 2272-2277, 2010.

[4] O. Helgason and K. Jonsson, “Opportunistic networking in OMNeT++,” in SIMUTools ’08: Proceedings of the 1st International Conference on Simulation Tools and Techniques, 2008.

[5] Christophe Dugas,”Configuring and managing a large-scale monitoring network: solving real world challenges for ultra-low-powered and long-range wireless mesh networks”, International Journal Of Network Management, Vol.15, pp. 269–282, 2005.

[6] “The network simulator(ns-2),” http://www.isi.edu/nsnam/ns/

[7] Gregory L. McColm,”Mathematical Logic Quarterly”, Volume 41, Issue 1, pages 111–134, 1995.

[8] Boukerche, A.; Nakamura, E.F.; Loureiro, A.F. "Algoritms for Wireless Sensor Networks. In Algorithms and Protocols for Wireless Sensor Networks", Boukerche, A., Ed.; John Wiley & Sons: Hoboken, NJ, USA, 2009.

[9] Tilak, S.; Abu-Ghazaleh, N.B.; Heinzelman, W. A Taxonomy of Wireless Micro-Sensor Network Models. Mob. Comput. Commun. Rev. pp. 6, 28–36, 2002.

[10] Lindsey, S.; Raghavendra, C.S. PEGASIS: Power-Efficient Gathering in Sensor Information Systems. In Proceedings of the Aerospace Conference, Big Sky, MT, pp. 1125–1130, March, 2002.