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A Study over an energy efficient MAC protocol in Heterogeneous Network for Intrusion Detection

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Abstract; Intrusion detection in Wireless Sensor Network (WSN) is widely used in many applications such as detecting an intruder. The intrusion detection is a mechanism for a Wireless Sensor Network to detect the existence of inappropriate, incorrect or unsuspicious moving attackers. WSN consumes lots of energy to detect an intruder. The main objective of this approach was developed under J Frame Builder tools is to provide simple and secure algorithm for energy efficient approach for external intrusion as well as internal intrusion detection. Wireless sensor networks (WSNs) often consist of tiny devices with limited energy, computational power, transmission range, and memory. WSNs offer a variety of potential means to monitor environments. Furthermore, we consider two sensing detection models: single-sensing detection and multiple-sensing detection. Our simulation results show the advantage of multiple sensor heterogeneous WSNs.

Index Terms- Intrusion detection, sensor nodes, Wireless Sensor Network (WSN), MAC layer, IEEE 802.11, Heterogeneous WSN.

I. INTRODUCTION

WIRELESS sensor networking is an emerging technology that has a wide range of potential applications including environment monitoring, smart spaces, medical systems and robotic exploration. Such a network normally consists of a large number of distributed nodes that organize themselves into a multi-hop wireless network. Each node has one or more sensors, embedded processors and low-power radios, and is normally battery operated. Typically, these nodes coordinate to perform a common task .Like in all shared-medium networks; medium access control (MAC) is an important technique that enables the successful operation of the network. One fundamental task of the MAC protocol is to avoid collisions so that two interfering nodes do not transmit at the same time. There are many MAC protocols that have been developed for wireless voice and data communication networks. Typical examples include the time division multiple access (TDMA), code division multiple access (CDMA), and contention-based protocols like IEEE 802.11 .To design a good MAC protocol for the wireless sensor networks, we have considered the following attributes. The first is the energy efficiency. As stated above, sensor nodes are likely to be battery powered, and it is often very difficult to change or recharge batteries for these nodes. In fact, someday we expect some nodes to be cheap enough that they are discarded rather than recharged. Prolonging network lifetime for these nodes is a critical issue. Another important attribute is the scalability to the change in network size, node density and topology. Some nodes may die over time; some new nodes may join later; some nodes may move to different locations. The network topology changes over time as well due to many reasons. A good MAC protocol should easily accommodate such network changes.Other important attributes include fairness, latency, throughput and bandwidth utilization. These attributes are generally the primary concerns in traditional wireless

voice and data networks, but in sensor networks they are secondary. We have identified the following major sources of energy waste. The first one is collision. When a transmitted packet is corrupted it has to be discarded, and the follow-on retransmissions increase energy consumption. Collision increases latency as well. The second source is overhearing, meaning that a node picks up packets that are destined to other nodes. The third source is control packet overhead. Sending and receiving control packets consumes energy too, and less useful data packets can be transmitted. The last major source of inefficiency is idle listening, i.e., listening to receive possible traffic that is not sent. This is especially true in many sensor network applications. If nothing is sensed, nodes are in idle mode for most of the time. However, in many MAC protocols such as IEEE 802.11 or CDMA nodes must listen to the channel to receive possible traffic. Many measurements have shown that idle listening consumes 50–100% of the energy required for receiving. For example, Stemm and Katz measure that the idle receive:send ratios are 1:1.05:1.4 [2], while the Digit an 2Mbps Wireless LAN module (IEEE 802.11/2Mbps) specification shows idle: receive: send ratios is 1:2:2.5.

Early study on wireless sensor networks mainly focused on technologies based on the homogeneous wireless sensor network in which all nodes have same system resource. However, heterogeneous wireless sensor network is becoming more and more popular recently. And the results of researches show that heterogeneous nodes can prolong network lifetime and improve network reliability without significantly increasing the cost .A typical heterogeneous wireless sensor networks consists of a large number of normal nodes and a few heterogeneous nodes. The normal node, whose main tasks are to sense and issue data report, is inexpensive and source-constrained.

II. SENSOR-MAC PROTOCOL DESIGN

In the wireless sensor networks, for designing high-quality MAC protocol, these attributes are to be measured :

- Energy Efficiency: Energy efficiency are the first attribute. Battery powered consist in The sensor nodes and it is often extremely complicated to change or recharge batteries for these sensor nodes. Sometimes it is helpful to replace the sensor node rather than recharging them.
- Latency: The second is latency. Latency requirement basically depends on the application. the detected events must be reported to the sink node in real time In the sensor network applications, so that the suitable action could be taken immediately.
- Throughput: With different applications the throughput requirement also varies. A few sensor network application require to sample the information with fine temporal resolution. In such sensor applications it is better that sink node receives more data.
- Fairness: In several sensor network applications when bandwidth is limited, it is compulsory to confirm that the sink node receives information from all sensor nodes fairly. However along with all of the above aspects the energy efficiency and throughput are the key aspects. By minimizing the energy wastage energy efficiency can be increased .

III. ENERGY WASTE IN MAC PROTOCL

The reason of wastage of energy in a MAC protocol for wireless sensor networks are the

following .

- Collision: - Some time the packet gets corrupted during transmission these packet need to be discarded and resent, these lead to increased energy consumption.
- Control Packet Overhead:- Energy is also required for Sending and receiving control packets due to this less useful data packets can be transmitted Idle Listening: - Extra energy is also consumed for Listening to receive possible traffic which is not sent.
- Overhearing:- Sometime nodes can pickup which are destined to other nodes. These also leads to unnecessary consume of energy. Reducing the energy wasted idle listing protocols like SMAC, TMAC and CMAC can be used. SMAC Traditional wakeup scheduling approach which uses fixed duty cycle.

Duty Cycle =Listen Interval/ Frame Length

SMAC and TMAC reduce energy consumption by using Co ordinated scheduling, but this requires periodic synchronization. CMAC supports low latency and avoids synchronization overhead [6]. CMAC allows operation at very low duty cycles by using unsynchronized sleep scheduling .TMAC uses adaptive duty cycle and has the advantage of dynamically ending active part [1].

IV. HETEROGENEOUS WSN

A heterogeneous wireless sensor network (WSN) consists of several different types of sensor nodes (SNs). Various applications supporting different tasks, e.g., event detection, localization, and monitoring may run on these specialized sensor nodes. In addition, new applications have to be deployed as well as new configurations and bug fixes have to be applied during the lifetime. In a network with thousands of nodes, this is a very complex task .A heterogeneous node has more complex processor and memory so that they can perform sophisticated tasks compared to a normal node. A heterogeneous node possesses high bandwidth and long distant transceiver than a normal node proving reliable transmission.

4.1. Types of Heterogeneous resources

There are three common types of resource heterogeneity in sensor node:

4.1.1. Computational Heterogeneity:

Computational heterogeneity means that the heterogeneous node has a more powerful microprocessor and more memory than the normal node. With the powerful computational resources, the heterogeneous nodes can provide complex data processing and longer term storage.

4.1.2. Link Heterogeneity:

Link heterogeneity means that the heterogeneous node has high bandwidth and long-distance network transceiver than the normal node. It can provide more reliable data transmission.

4.1.3. Energy Heterogeneity:

Energy heterogeneity means that the heterogeneous node is line powered, or its battery is replaceable.

Among above three types of resource heterogeneity, the most important heterogeneity is the energy heterogeneity because both computational heterogeneity and link heterogeneity will consume more energy resource. If there is no energy heterogeneity, computational heterogeneity and link heterogeneity will bring negative impact to the whole sensor network, i.e., decreasing the network lifetime.

A heterogeneous node is line powered (its battery is replaceable).The heterogeneous WSN consists of different types of sensors with different sensing and transmission range. So while selecting the sensor nodes

for intrusion detection, we need to consider these inequality of sensing and transmission range. For example, if two nodes have different transmission range it is better to select the one whose transmission range is higher. In this paper, we are considering N types of sensors. Here the sensing range and transmission range is high for Type 1 compared to Type2 and so on. The sensors are uniformly and independently deployed in a area A = LxL.

V.COMPARATIVE STUDY OF HETROGENEOUS WSN AND HOMOGENEOUS WSN

In homogeneous networks, all the sensor nodes are identical in terms of battery energy and hardware complexity. heterogeneous networks achieve the former and the homogeneous networks achieve the latter. In homogeneous network, single (uniform) platform is used for per research group and all nodes in the network share the same functionality where as in heterogeneous network all the nodes treated differently. In the real world, the assumption of homogeneous sensors may not be practical because sensing applications may require heterogeneous sensors in terms of their sensing and communication capabilities in order to enhance network reliability and extend network lifetime. Also, even if the sensors are equipped with identical hardware, they may not always have the same communication and sensing models. In fact, at the manufacturing stage, there is no guarantee that two sensors using the same platform have exactly the same physical properties. This taxonomy focuses on heterogeneity at the designing stage, when sensors are designed to have non identical capabilities to meet the specific needs of sensing applications.

In the heterogeneous wireless sensor network, the average energy consumption for forwarding a packet from the normal nodes to the sink in heterogeneous sensor networks will be much less than the energy consumed in homogeneous sensor network.

VI.CONCLUSION

This paper presents the study of an energy efficient intrusion detection technique for the heterogeneous networks which can improve the life of wireless sensor network. By using this techniques we can use efficiently the network .and in further our study we will study about security in WSN networks.

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