DDOS Attack Detection And Handling Mechanism In WSN

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Abstract: Wireless sensor network (WSN) uses in many distinct applications including real time event detection. Sensor nodes (SN) have limited energy associated with them that is required to be conserved. Once all the energy of the sensor is drained, then network dies. In addition sensor nodes are exposed to everyone hence SN is susceptible to attacks. Distributed denial of service attack is one of the common attacks caused by malicious attacker causing congestion and decay in lifetime of the network. DDOS attack floods network with the bogus requests. This causes the legitimate request to be avoided by the server due to lack of resources. Detection and prevention of such attacks thus becomes critical. This paper provides study of techniques used to detect DDOS attack along with suggest modification for improving classification accuracy in the detection techniques. In addition this paper also highlight other metrics such as mean time to failure and mean time between failure for improving the detection process.

Keywords: Wireless sensor network, distributed denial of service attack, Mean time between failure, mean time to failure

I. INTRODUCTION

Wireless sensor network[1] is becoming need of the hour since it is accessible to everyone and uses wireless medium to communicate. This communication needs the sensors to obtain routing information of the neighbouring nodes. The transmission of information from source to destination is dependent upon the topology. The topological advancement leads to efficient transfer of data causing least energy to be consumed. The basic topologies including bus, star and ring topologies are expanded to include energy efficient procedures for communication. [2], [3]Clustering is one of the strategies to minimise energy consumption during transmission in WSN. As the strategies are researched over for reducing energy consumption and increasing lifetime of the network, WSN becomes exposed to malicious users. [4] Malicious users causing the congestion over the network leading to request denial and hence lifetime of the network degrades. [5], [6] The request denial leads to attacks and most common of them is DDOS(Distributed denial of service attack). [7] This attack causes repeated requests to be generated and network bandwidth to be consumed unnecessarily. This paper provides the in-depth into the distributed denial of service attack along with comparative study of techniques used to rectify the problem caused by DDOS attack. The modifications required to improve the techniques is listed in tabular structure and hence is beneficial for future enhancement. Rest of the paper is organised as under:

- Section 2 gives the brief introduction and side effects of DDOS attack
- Section 3 gives the DDOS detection techniques along with comparative analysis of each
- Section 4 gives the research gap
- Section 5 gives the conclusion and
- Section 6 gives the references of the literature used in this survey

II. DDOS ATTACK: OCCURRENCE AND SIDE EFFECT

[8] Distributed denial of service attack causes congestion within the network and hence service denial occurs. The node possessing the resources receives undue requests that block the services and hence starvation is the result. [9], [10] This attack is kind of active attack that distorts the routing process. This attack may be due to presence of node failure un-intentionally or due to malicious attack. In active attack, content to be delivered to the destination is altered within the network and hence service denial occurs. The node possessing the resources receives undue requests.

- Physical layer: This layer can be hampered by sniffing attack that may or may not harm the physical environment required to transmit the data.
- Data Link Layer: Passive as well as active sniffing along with ARP spoofing causes network to deny requests.
- Network layer: Sniffing and denial of service attacks that allow the traffic to pass through it and then attack the route to block it.
- Transport layer: Denial of service hold impact at this layer. In other words this attack is king at this layer. Information about the machines working within the network is disclosed using such attacks at this layer. Services both online as well as offline will be affected through this attack.
- Session and Presentation layers: These layers are not practically tested and hence no attack is yet discovered at these layers.
- Application Layer: This layer is exposed to both active as well as passive attacks. Distributed denial of service is common at this layer.

[7][11][12] The side effect of this attack is congestion and starvation problem. The DoS attacks and it side affect is comparatively given as under

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| Layer                | Task                                           | Attack                                | Side effects                                          |
|----------------------|------------------------------------------------|---------------------------------------|------------------------------------------------------|
| Physical             | Converting data to be transmitted in the form of bits and bytes | Sniffing, DDOS                        | Starvation and resource wastage. Lifetime of the network decay |
| Data Link            | Forming frames from the bits received from physical layer | Passive and active DDOS attacks       | Packet drop ratio increases and lifetime of the network decreases |
| Network Layer        | Receiving data from data link layer and forming packets | Sniffing and denial of service attack  | Congestion due to repeated requests                  |
| Transport            | Using UDP and TCP to locate the route from source to the destination | Denial of service                     | Service denial at this layer causes unreliability and congestion |
| Session and presentation | Session establishment and presentation is critical so that receiver can receive the data in understandable format | No attack is disclosed as yet          | ----------- |
| Application Layer    | Protocols necessary for transmission is accommodated at this layer | DDOS, Sniffing and spoofing           | Packet loss, lifetime decay                          |

Table 1: Layers, attack types and side effects

DDOS attack hampers the performance of network as packet droop ratio increases along with decay in lifetime of the network. Techniques have been devised to tackle DDOS attack within WSN. Next section describes the mechanisms used to detect DDOS attack within WSN.

III. DDOS ATTACK DETECTION TECHNIQUES

DDOS attack detection mechanisms suffer from issues of high energy consumption while detecting attack along with limited availability of resources. Attacks could be active or passive in nature. Active attacks alter the contents to be transmitted and hence are more dangerous as compared to passive attacks which only sniff but do not alter the contents. DDOS attack detection mechanisms along with merits and demerits of each is presented

| DDOS Attack Detection mechanism | Description and Merit | Demerits | Parameter Enhanced | Future enhancement |
|---------------------------------|-----------------------|----------|--------------------|--------------------|
| UDP Flood attack detection[13]  | Flood attack detection strategy employs identity detection mechanism to block the packets initiated from source beyond threshold. | High consumption of energy due to lack of energy conservation procedures. | Bits per seconds parameters measure the magnitude of attack | Threshold mechanism can be dynamic that should depend upon the traffic flow. |
| Smurf DDOS Attack detection[14] | Smurf attack minimisation is achieved through bandwidth reservation mechanism to reduce attack percentage | Bandwidth conservation affects utilization of resources and reduces availability | Bits per second and hertz | Resource degradation and wastage must be tackled. This can be achieved by dividing the entire bandwidth into channels and blocking channels having malicious traffic |
| Syn flood DDOS attack[15]      | This attack takes into consideration a back approach of TCP connection and can be prevented using blockage based strategy where malicious traffic is blocked even before reaching the site | Estimation before the attack is challenging task | Bits per seconds | Filtering strategy to pre-process the traffic could be used to reduce execution time for attack detection |
Ping of attack detection strategy[16]  | In this attack multiple malicious pings are transmitted to the server to block the services provided by the server. Memory buffer overflow is the problem that is handled efficiently by putting constraint on the memory utilization through the request by the single client. | Legitimate packets could be denied for the resources | Bits per second and Hertz | Blocking contents to be stored within memory must be accompanied with compaction to increase the access rate.

Slowloris detection and prevention[17]  | This attack attacks the specific server and makes some specific service down while other ports are unaffected. This attack is detected and avoided by eliminating more than one connection from the client side. | In case client attacks by the use of virtual public network, then this type of attack cannot be detected | Preemption in the resource allocation could solve the problem of slowloris

Http flood detection[18]  | This type of attack causes the maximum resources to be allotted to the client in response to the Http request but is tackled to apply check on the resource allocation process causing limited resource to be allotted the client | Critical resource could be avoided for allocation and hence resource consumption reduces considerably | Proportionate allocation mechanism with threshold could increase the resource utilization.

Table 2: DDOS attack detection and future enhancements

The most crucial and difficult attack to detect and resolve is Http flood detection. Proportionate allocation with threshold on upper limit on resource that could be allotted to clients could resolve the problem and enhance the performance of the WSN in terms of packet drop ratio and lifetime of the network.

IV. RESEARCH GAP

DDOS attack is a result of exposure of sensor nodes to malicious and unauthorised users. The limited work has been done towards the detection and prevention of Http flood attack. The http flood attack causes large number of resources to be allotted in response to the few requests from the clients. Placing check on the allocation process reduced the problem but also reduces the resource consumption. To tackle the issue proportionate allocation with check on the number of resources to be allotted to the client could be suggested for future enhancement of the existing strategy.

V. CONCLUSION

This paper presents the comprehensive analysis of the DDOS attack and mitigation strategy. The tackling of attacks is researched over and is discussed through Table 2 in section 3. The flooding is common base from where DDOS attack is initiated and its profound affect is seen in the network and transport layers. The most common method to mitigate this attack is to use threshold on the number of resources to be allotted. This mechanism lowers the chances of DDOS attack but also reduces the availability and resource consumption. In order to rectify the issue, proportionate allocation with check on the resource allocation is propose in the future endeavours.

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