

# Building a Secured and Performance Efficient VLAN in Wireless Ad hoc Network

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**Abstract** - A VLAN is not a physical connection but a logical one that allows network devices to be combined as "virtual LANs". By this characteristic, VLAN divides the network into different broadcast domains so that packets are only delivered between ports that are combined for the same VLAN. Wireless ad hoc networks consist of multiple devices with flexible network topology. The communications might be needed for few wireless devices but not all devices in an ad hoc network. So there is a need to form multiple-group in an ad hoc network as "virtual LANs" to ensure better performance and efficient use of network bandwidth. In this paper, we propose a secure VLAN construction protocol (SVCP) in wireless ad hoc networks to provide security to the packets along with efficient performance. Security is provided by using Diffie Hellman Algorithm for key generation, encryption and decryption. Broadcast drawback is eliminated by making the server node serve as a temporary agent to form a VLAN. Therefore, SVCP efficiently improves the utilization of bandwidth and security in wireless ad-hoc VLAN. An inter VLAN broadcast message to display emergency flash messages on all the systems in the VLAN.

**Key Words:** Virtual LAN, Dynamic Network Topology, Wireless Ad hoc Networks, Network Bandwidth, Group Key, Client, Server, Security, Diffie-Hellman, Encryption, Decryption.

## 1. INTRODUCTION

A VLAN is a logical connection that allows network devices to be combined as "virtual LANs". By this characteristic, VLAN segments the network into different broadcast domains so that packets are delivered only between ports that are combined for the same VLAN. A VLAN behaves like an ordinary LAN, but the connected devices are not physically connected to the same segment. While devices may be physically distributed anywhere on a network, they are grouped together by VLAN technology, and broadcasts are sent to all the devices within the same VLAN. A wireless ad hoc network consists of multiple devices, which do not have a fixed network topology. The communications are not needed for all devices in an ad hoc network. Therefore, an ad

hoc network needs to form multiple-group as "virtual LANs" to ensure reasonable performance and efficient use of network bandwidth. An ad hoc wireless network consists of a system of collection of two or more wireless mobile nodes that can freely and dynamically self-organize into arbitrary, dynamic and temporary network topology. Any node can communicate with any other node present in the network. Individual nodes can even send a broadcast message over the network. By the broadcasting protocol, these packets will be received over the wireless network, which results in wasteful bandwidth and insecurity. Therefore, an ad hoc network needs to be parted into multiple-groups as "virtual LANs" that can reduce redundant transmission and ensure efficient utilization of bandwidth. It also needs individual group key to encrypt its information for security. An inter VLAN broadcast message to display emergency flash messages on all the systems in the VLAN.

## 2. RELATED WORK

VLAN can be used to form Virtual Workgroups, to constrain broadcast traffic and to enhance the security of networks. Hence, it offers benefits in terms of efficient use of bandwidth, flexibility, performance and security. A wireless ad hoc network has no fixed infrastructure available, so no fixed device can serve as LAN's switch to administrate the configuration about ad hoc VLAN. Each node should cooperate to maintain the network topology and packets transmission.

By using the existing broadcasting protocol, multiple packets from each of the nodes will be received over the wireless network. It results in wasteful bandwidth. Each of the nodes, which wants to form their respective VLANs, will initiate the VLAN construction process, which results in redundancy. Each of the nodes will receive the packets which it should not access leading to insecurity.

## 3. PROPOSED WORK

We have proposed a server-initiated communication session. Each VLAN network consists of N nodes and a server, which

are distributed over a specified region. The server effectively reacts when it receives the VLAN-join-request packet from any of the node that reduces redundant transmissions. In this project, we propose a secure VLAN construction protocol (SVCP) in wireless ad hoc networks to provide security to the packets along with efficient performance. Security is provided by using Diffie Hellman Algorithm for key generation, encryption and decryption. Broadcast drawback is eliminated by making the server node serve as a temporary agent to form a VLAN. The server effectively reacts when it receives the VLAN-join-request packet from any of the node that reduces redundant transmissions. Therefore, SVCP efficiently improve the utilization of bandwidth and security in wireless ad-hoc VLAN. An inter VLAN broadcast message to display emergency flash messages on all the systems in the VLAN.

### 3.1 Advantages of Proposed Work

- Parting an ad hoc network into multiple-groups as “virtual LANs” and using single server node initiation for the creation of each VLAN can reduce redundant transmission and ensure efficient utilization of bandwidth.
- It also uses an individual group key to encrypt its information for security.
- Efficient way of spreading messages faster in case of emergency.

### 3.2 Architecture

The design mainly consists of five stages. They are:

- Initiation
- Key Generation
- Encryption
- Transmission
- Decryption

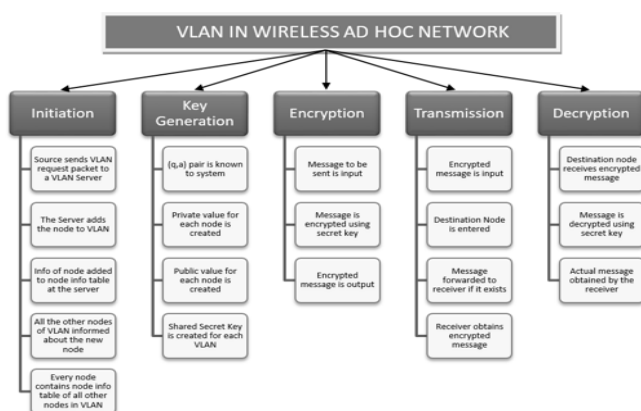


Fig -1: Architecture of VLAN in Wireless Ad hoc Network

### 3.3 Implementation of Proposed Work

- When a server is setup, its NodeListener starts running. NodeListener continuously searches for an incoming VLAN-join-request packet.
- A new node sends VLAN-join-request packet to one of the available server. NodeListener of that server accepts the request and assigns it a port number.
- TempClientListener listens to the information sent by the server and displays it , i.e, Port No, etc.
- Once the connection is established, TempClientListener activates AllNodeListener which sends and receives messages and updates information of other nodes on the network.
- NetworkGraph is used to display the connected nodes in the network and is achieved using TextThread.

### 3.4 Steps Involved in Implementation

- The IP Address of each of the devices (i.e, laptops) through which it is connected to the network is found out by the use of java in-built function of InetAddress Class.
- The Admin can create a server for each of the VLAN inside the network. The Server is responsible for VLAN Formation. We are using Java Frame for creation of Server named Server suffixed by its VLAN ID (e.g. 1,2,3 and so on).
- Every VLAN comprises of an independent server, which takes care of formation of VLAN by accepting request from all of the nodes that wants to join that particular VLAN. It also keeps track of all the nodes which are a part of that VLAN. The details of the nodes are kept in an AllNodeTable inside the server. Each of the server is also associated with a network graph which represents the exact location of all the nodes which are present in the VLAN.
- Each of the server is associated with a network graph which represents the exact location of all the nodes which are present in the VLAN. It is the representation of the physical network structure of each VLAN. This is taken care by the NetworkGraph Java Frame.
- After the Server is created, it can be started. At start-up, the server creates a new instance (through the use of thread) of Node Listener which waits for the request from nodes to join the VLAN. NodeListener Thread waits infinitely for the join request from the nodes. When it receives a join request from any of the nodes, it records all the details of nodes and provide it a new port number for further communication such as sending and receiving messages. Further, it creates a separate thread for that node in Network Graph to take care of its existence in the network graph. The existence

of that node is updated in the network graph. Lastly, it sends a connection accepted response to the node along with the new port number assigned to it.

- The properties of each node is set at the time of the node creation. The properties comprise of the transmission range as well as the location of each node w.r.t x and y-axes. This is taken care by SetNodeProperties Class.
- We need to render the image of the node in order to display it on the network graph. The image is fetched from the local drive in a separate module to support modulation of the project. The image of each node is unique and is created using in-built JAVA Class known as Graphics. After creating the image, it is stored on local drive and is further fetched from there in order to display it on the network graph.
- After the image of node is rendered, it needs to be displayed on the network graph. Separate thread is created for each of the node inside a VLAN in order to display it on the network graph. The thread runs continuously until the node moves out of the VLAN. This is taken care by a separate user-defined class named TextThread suffixed by the VLAN Id (e.g. 1,2,3 and so on).
- Every node is a separate instance of Node Java Frame which joins a VLAN. Every node has its own property such as transmission range and its physical location which are set by the server of the VLAN in which it wants to join. Whenever a node is created, it possess its own java frame through which it can connect to the server of a particular VLAN. If the node wants to connect to the server, the button "Connect to Server" is pressed which sends a join request to the VLAN Server which further provides connection to the node.
- Each of the node contains a "Send" button along with the text field to enter the message and the receiver to whom the node wants to send the message. After entering the destination node and the message, "Send" button can be pressed to send the message. Further, there is a text field for received message and the sender of that message present on the frame of each of the nodes to display the received message from the other nodes along with its identity.
- After sending the join request, each of the node temporarily waits on a TempClientListener Thread until it receives connection response from the server. After receiving the response of connection

from the server, the thread is destroyed and each of the node is given a permanent thread named AllNodeListener for further communication with other nodes in the network.

- After the VLAN is formed, each of the nodes can communicate with any of the nodes inside the same VLAN directly. After receiving the response of connection from the server, the TempClientListener thread is destroyed and each of the node is given a permanent thread named AllNodeListener for further communication with other nodes in the network. Each of the node contains a "Send" button along with the text field to enter the message and the receiver to whom the node wants to send the message. After entering the destination node and the message, "Send" button can be pressed to send the message. After the message is sent successfully, a pop up occurs to inform user of the node.
- Further, there is a text field for received message and the sender of that message present on the frame of each of the nodes to display the received message from the other nodes along with its identity. Similarly, when a message is received by a node, a pop-up is displayed on the screen to inform the user of the node about the message. This class also takes care of node update inside the VLAN whenever a new node joins the VLAN or an existing node moves out of the VLAN.
- We have used Diffie-Hellman Algorithm which uses a key generation algorithm known as Diffie-Hellman Key Generation Algorithm to generate key for encryption and decryption of data which is transmitted from one node to another inside the network. This enhances the security of the VLAN network. The data in message is firstly encrypted and then sent over the network by the sender node. Similarly, the receiver, after receiving the message, decrypts it and then read the original message.

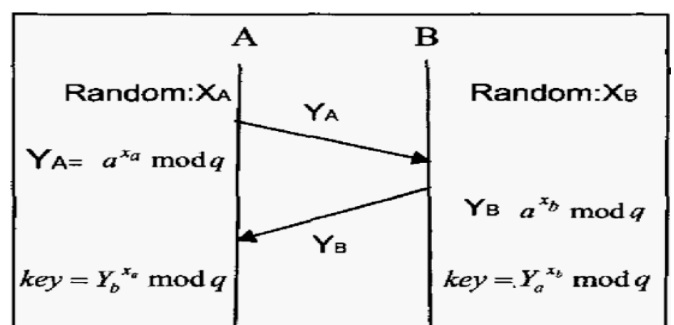


Fig -1: Diffie-Hellman Key Generation Algorithm

#### 4. CONCLUSIONS

In this paper, we have described the secure VLAN construction protocol (SVCP) in wireless ad hoc networks. The main objective of SVCP is to progress the behaviors of ad hoc VLANs initiation, participation and generating secure group key. VLAN-join-request packet and VLAN-join packet, allows the procedure to be implemented easily. The shared group key generated securely. Secure communication is achieved by way of using group key to encrypt and decrypt information. SVCP can efficiently compose ad hoc VLAN for multi-group communication and improve the broadcast drawback in ad hoc network. Therefore, SVCP efficiently improve the utilization of bandwidth and security in wireless ad-hoc VLAN. An intra-VLAN broadcast message is used to display emergency flash messages on all the nodes inside a VLAN. Also, we are using an inter-VLAN broadcast message to display emergency flash messages on all the nodes on the entire network.

The project can further be extended for social purpose such as Women Safety where women in a specific locality can use the nodes to notify some serious concerns to the police. The port number used for nodes, which were destroyed, can be reallocated for other nodes, which we can enhance further in order to support node destruction in an efficient way. The server can be used for other operations when no nodes are connected to it.

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