Improving Performance with Security Mechanism for Wireless Multi-Hop Relay Network

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Abstract—Wireless relay network consist of distribution of network topology commonly used in wireless network. Where it sender and receiver are interconnected by mean of some mobile nodes. Relay technology are used enhance packet delivery and increase performance of wireless networks such as worldwide interoperability for microwave access and LTE-A. Later developed automatic repeat request (ARQ) [11] technique that to reduced packet lose and increase latency but we recognizes potential drawbacks of automatic repeat request techniques that’s are ambiguous error report, packet overhead and number of acknowledgement in case of successful received data. Authentication schema is most important factor in relay network to secure, protect from attackers because of thousands of users are communicated each other’s without any identification. Authentications in relay network have been proposed public-key cryptographic algorithm developed based on Diffie-Hellman key exchange algorithm. The process of Diffie-Hellman key exchange algorithm is two users to securely exchange a keys that keys ultimately used to encrypt the message. Our research is going on reduced workload in relay network and improve performance by consider some Components that mobility factor, battery power and workload. These components Consider to establishing reliable path to reduced delay and increase data transmission speed and finally data transmission is one of major problem in wireless network then we consider hop-by-hop scheme.

Index Terms—Authentication, establish reliable path, hop-by-hop communication

I. INTRODUCTIONS

Wireless relay network (Tzu-Ming Lin, Wen-Tsuen Chen and Shiao-Li Tsao 2013) consist of distribution of network topology commonly used in wireless network. Where it sender and receiver are interconnected by mean of some relay nodes. In such network the sender and receiver cannot communicate to each other directly because the distance between sender and receiver is greater than the transmission range therefore we need intermediate relay nodes. The development of these relay efficient way to communicated and secure to connecting millions of our customers at mobile stations as well as enhance packet delivery and efficient acknowledgement. Relay nodes with buffering Functions and packet decoding can improve efficient acknowledgement, throughput and capacity of relay node. Today such networks are Used in many companies to communicate customers that network are enhancing Packet delivery, efficient acknowledgement and improve throughput [11]. Earlier frame relay uses for faster growing wide area technology uses in large corporation, government and small business application and so on.

1) Mobile ad hoc network[13]: mobile ad hoc consist of a self-configuring infrastructure less network that group of mobile nodes connected wireless and it does not relay on prefixing infrastructure however each node participate in routing to forward data for other nodes instead it is decentralized type of wireless network. Mobile ad hoc can be used in variety of application such as air pollution it can facilitating collection of sensor data for data mining and mobile ad hoc including several application such as battlefield communication, emergency fire response. 2) Frame relay network: relay network is standard wide area network technology that described layered architecture of digital telecommunication channel using packet switching technology. Network providers developed frame wireless network for voice and data encrypted methodology used in local area network and wide area network. Frame relay network organized the transmission over different band with transparent to all end user using WAN protocol. Multi-hop. 3) Cellular network: This is wireless network distributed wide range area calls cells. In this wireless network each cell uses different frequencies from neighboring Cells to provide constant band with each cell and minimized interference. Multi-hop cellular architecture contain multiple hops for increasing throughput in this combined advantages of fixed infrastructure of base station and without infrastructure of ad hoc network Relay client authentication type[10] Relay network consist of each new user has unique private key to communicate with authentic manner in this network base station provide certificate signature (unique private key) and each user have public key certificate. These two public and private keys are using to communicate each other. Authentication is one of most important factor in relay network to secure, protect from attackers Because of thousands of users are communicated each other’s without any identification. Authentication Authentication schema is most important factor in relay network to secure, protect from attackers because of thousands of users are communicated each other’s without any identification. Authentications in relay network have been proposed public-key cryptographic algorithm developed based on Diffie-Hellman key exchange algorithm. The process of Diffie-Hellman key exchange algorithm is two users to securely exchanges a keys that keys ultimately used to encrypt the message it is implemented based on number theory to using prime number concept that each user has two key private and public these keys are act as primitive root conditions the security of attackers very difficult to break the keys because in Diffie-Hellman using modular functions but brute-force attack and man-in-middle Attack are possibility to break the codes. In Diffie-Hellman algorithm using has functions to avoid the attacks. Hop-by-Hop Relay Repeat Request Scheme Hear hop-by-hop relay[9][11] repeat request schema are

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using to implement the relay network in this scheme packets are transmitting hop-by-hop from source to destination via using intermediate nodes. See below finger

![Diagram of Hop-By-Hop Relay Repeat Scheme](image)

**Fig (1) Hop-By-Hop Relay Repeat Scheme.**

In this scheme every MS involved error control, response for detecting errors, acknowledgement and retransmission see above finger like as. When neighbor node received packets successfully then send Acknowledgement or loss packets then send negative acknowledgement these two operations are most important in relay network. In case loss packets then send retransmitted a data by using buffer storage management.

**Establish Reliable path**

In this section we consider reliable path by using components that are battery power, mobility factor and workload these components consider to select best nodes.

### II. PRESENT WORK

**Problem formulation:** Relay network is one of major field in wireless network and better ways to enhance packet delivery in wireless area network. One of major problem in relay network to increase workload in case of data transmission and authentication problem. Our research is going on reduced workload in relay network and improve performance by consider some components that mobility factor, battery power and workload. These components consider to establishing reliable path to reduced delay and increase data transmission speed and finally data transmission is one of major problem in wireless network then we consider hop-by-hop scheme. Authentication is second problem in relay network then we present proposed public-key cryptographic algorithm. This algorithm implemented based on Diffie-Hellman key exchange algorithm.

### 2.1 Proposed authentication algorithm

Let consider following steps for algorithm.

**Step 1)** Select public-key (P, Q) \( Q \rightarrow \text{prime number} \) and \( P \rightarrow \text{primitive root of } Q \) with condition \( P < Q \)

**Step 2)** User A and User B know public values

**Step 3)** User A select private number \( X_a \) and compute \( Y_a \)

Let consider \( Y_a = P^{X_a} \mod Q \)

Users A send \( Y_a \) to User B

**Step 4)** User B select private number \( x_b \) and compute \( y_b \)

Let \( y_b = P^{x_b} \mod q \)

User B send \( Y_b \) to User A

**Step 5)** Let consider \( ID, H \) values these values are \( ID, H > q \)

Let consider condition to Compute \( ID, H \) values and \( ID, H \) are relative prime of \( Q \)

That’s \( y_a^H = 1 \mod q \)

\( y_b^ID = 1 \mod q \)

**Step 6)** Compute \( Y_a' = P^{(X_a + ID + H)} \mod Q \)

User A send \( Y_a' \) to User B

**Step 7)** User B compute \( Y_a' \) value by using \( Y_a, ID, H \) values.

Expand equation like

\( (P^{Y_a} \mod Q) \ast (P^{ID \mod Q}) \ast (P^{H \mod Q}) \)

If both values are equal user A is authorized otherwise reject

See below method exchanging keys:
2.2 Reliable path established using node selection method
In this section we consider reliable path by using components that are battery power, mobility factor and workload these components consider to select best nodes See below flow chart to select nodes. We consider threshold values for each component these threshold values based to select a node. See below Figure reliable path established flow chart.

2.3 Problem objectives
Our research consider three objectives 1) first phase is establish reliable path in relay network to consider some components like mobility factor ,battery power and workload ,we will not consider shortest path
2) Second phase improve security using proposed authentication algorithm and
3) Third phase efficient way to data transmission by using hop by hop method. See below diagram for. Objective phases.
Our research following steps:
1. Randomly placing number of mobile nodes in network
2. All mobile node have mobility factor, battery power and workload except source node and base station
3. Proposed authentication algorithm using to exchange keys for authentic purpose.
4. Node selection method using to select a node
5. sending data using hop-by-hop communication

2.4 Methodology
In this section we are explained proposed technology to achieve our objectives. First of all gathering information from various optimized techniques and results is done to decide which technique should be used in this work .present proposed algorithm is best optimized solution. Let consider methodology Let consider example table 3.3 to establish reliable path by using node selection method
Minimum battery power=5V, minimum node speed=10 m/s, minimum work load=75% with transmission range of each node At T1 time
STEP 1) Create Relay Network: There are number of relay nodes are assigned randomly in network and each node consider mobility factor, Battery power and workload (change position after t time)except source node and base station see below diagram fig(4) to randomly assigned mobile nodes.

<table>
<thead>
<tr>
<th>node</th>
<th>Inside*(range) boundary</th>
<th>Outside*(range) boundary</th>
<th>Battery power</th>
<th>mobility</th>
<th>workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>A,B,D,C</td>
<td>F,E,H,G</td>
<td>4v</td>
<td>10m/s</td>
<td>65%</td>
</tr>
<tr>
<td>A</td>
<td>B,D</td>
<td>C,G,H,E,L,J</td>
<td>6v</td>
<td>5m/s</td>
<td>44%</td>
</tr>
<tr>
<td>B</td>
<td>F,G,J,E</td>
<td>L,J</td>
<td>6v</td>
<td>7m/s</td>
<td>32%</td>
</tr>
<tr>
<td>C</td>
<td>E,J</td>
<td>G,F,E,J,L</td>
<td>7v</td>
<td>8m/s</td>
<td>45%</td>
</tr>
<tr>
<td>D</td>
<td>G,J,F</td>
<td>L,J</td>
<td>6v</td>
<td>5m/s</td>
<td>65%</td>
</tr>
<tr>
<td>E</td>
<td>E,J</td>
<td>L,J</td>
<td>6v</td>
<td>4m/s</td>
<td>45%</td>
</tr>
<tr>
<td>F</td>
<td>E,J</td>
<td>L,J</td>
<td>7v</td>
<td>8m/s</td>
<td>66%</td>
</tr>
<tr>
<td>G</td>
<td>H,J</td>
<td>I</td>
<td>8v</td>
<td>4m/s</td>
<td>34%</td>
</tr>
<tr>
<td>H</td>
<td>I,J</td>
<td></td>
<td>11v</td>
<td>7m/s</td>
<td>22%</td>
</tr>
<tr>
<td>I</td>
<td>S</td>
<td></td>
<td>10v</td>
<td>15m/s</td>
<td>66%</td>
</tr>
<tr>
<td>J</td>
<td>S</td>
<td></td>
<td>12v</td>
<td>10m/s</td>
<td>23%</td>
</tr>
</tbody>
</table>

Fig (4) Assigned Random Nodes

STEP 2) Authentication: Second step is authentication to exchange the keys in which randomly selected paths there is no conditions as show below diagram.

Fig (5) Authentication between Source and Destination

STEP 3) Select the Nodes and Send Data: Select the nodes by using node selection method and send data source to destination by using hop-by-hop communication as show below diagram. in this step node C,J are rejected nodes because didn’t satisfied condition see above table. Acknowledgement when neighbor node received data successfully then replay acknowledgement or in case failure data then send negative acknowledgement again retransmit the data.

Fig (6) Select Nodes in Relay Network.

STEP 4) acknowledgement path: When base station received data successful then send mobile acknowledgement see below diagram like as.

Fig (7) Acknowledgement Path

STEP 5) data sending hop-by-hop repeat request schema: Hear hop- by- hop relay repeat request schema are using to implement the relay network In this scheme packets are transmitting hop-by-hop from source to destination via using intermediate nodes. In this scheme every MS involved error control, response for detecting errors, acknowledgement and retransmission see above finger like as. When neighbor node received packets successfully then send Acknowledgement or loss packets then send negative acknowledgement these two operations are most important in relay network. In case Loss packets then send retransmitted a data by using buffer storage management.

Fig (8) Sending Data Hop-By-Hop Scheme
2.5 Result and Discussion

Network performance for proposed methodology.

Throughput: The graph showed throughput of proposed methodology. Network throughput is the average rate of successful packet delivery over a communication channel.

Energy consumption: Mobile nodes consider battery power, workload, and mobility factor; these components based to establish reliable path and these factors based to calculate energy consumption of successful packet delivery over a communication channel.

Packet delivery ratio: The graph showed packet delivery ratio of proposed methodology. In data are sending hop-by-hop method. The graph shows the average rate of successful packet delivery over a communication channel.

Change battery power: Each mobile node considers battery power consumption depending on transmission range, received data packets, processing, and mobility factor. Let see below graph change battery power. See figure 11.

Change workload: Each mobile node consists of CPU usage mainly due to each process execution time, retransmission data in case of loss packets and mobility factor. See below figure 12 how to change CPU utilization.

III. CONCLUSION AND FUTURE

In our research, we are going on to reduce workload in relay network and improve performance by considering some components like mobility factor, battery power, and workload. These components consider to establish a reliable path to reduce delay and increase data transmission speed and finally, data transmission is one of the major problems in wireless networks. Then we consider hop-by-hop scheme. Authentication is another problem in relay network. This algorithm works on key exchanging between source and destination. Finally, our proposed result is an optimized solution compared to previous techniques, and our proposed analysis work is fine. In our project, minor packet loss, error control, but it does not affect over services.
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Future scope
Authentication and performance are important in Relay network. Further performance can improve by keeping the computation overheads simple.

1) Further security can be improved by using hash functions or any other public key cryptographic algorithms
2) There are many other components like bandwidth, co-coordinators etc. consider to improved performance in relay network.

REFERENCES


