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A NEW APPROACH TO DIFFIE-HELLMAN KEY EXCHANGE ALGORITHM

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ABSTRACT: ***Diffie-hellman was the first published public key algorithm that is used for secure key exchange mechanism. The purpose of algorithm is used to enable users to security exchange a key that can be used for subsequent encryption. This cryptographic problem ensure A (resp. B) that no other participants aside from B (resp. A) can learn any information about the agreed value and often also ensure A and B that their respective partner has actually computed this value. But this algorithm is no longer strong, since the key can be easily identified by discrete logarithmic approach. Hence, in order to strengthen this algorithm, we are going to generate private keys by our own mathematical equations. The user alone is going choose keys from many available factors for that mathematical equation that is already defined. Hence, it is difficult for the intruder to identify the correct factor for the equation that we framed.***

1. Introduction

Whitfield Diffie and Martin Hellman discovered what is now known as the Diffie-Hellman (DH) algorithm in 1976. It is an amazing and ubiquitous algorithm found in many secure connectivity protocols on the Internet. DH is a method for securely exchanging a shared secret between two parties, in real-time, over an untrusted network. A shared secret is important between two parties who may not have ever communicated previously, so that they can encrypt their communications. As such, it is used by several protocols, including Secure Sockets Layer (SSL), Secure Shell (SSH), and Internet Protocol Security (IPSec).

2. Algorithm for Existing System

The algorithm chooses two public known numbers a prime number n and g that is primitive root of n. Suppose user A and B wish to exchange a key for their communication, then user A select random integer(private key) $X_a < n$ and compute public key $y_a = g^{xa} \bmod n$. Then user B select random integer(private key) $X_b < n$ and compute public key $y_b = g^{xb} \bmod n$. Secret key compute by A is $K = y_b^{xa} \bmod n$. similarly Secret key compute by A is $K = y_a^{xb} \bmod n$.

(a) Insecure against attacks

The algorithm is insecure against man in the middle attack as follows, Suppose there is a user C who is going intercept the secret key shared between user A and user B. C generates two random private keys $x_{d1}$and x_{d2} and then computes corresponding public keys y_{d1} and y_{d2}. User A transmits public key y_a to user B. in the meanwhile user C intercepts y_a and transmits his public key y_{d1} to user B. user C also calculate $K2 = y_{d2}^{xa} \bmod n$. B receives y_{d1} and calculate secret key $K_1 = y_{d1}^{xb} \bmod n$. Now, user B transmits his private key x_a to A. Now, C intercepts and transmits his own public key y_{d2} to A. Now, A receives y_{d2} and calculates corresponding K_2. Since the algorithm is easily cracked by discrete logarithm approach as above, we have to strength the algorithm to avail better security key transmission.

3. Contribution of work

In order to increase the strength of the algorithm, we are going to generate the private keys using pseudo random number mechanism. In our method , we are defining our own mathematical equations to generate values for both X_a and X_b. Suppose we are generating value by the equation $X_a = a*b*c$ and generating $X_b = a+b+c$. For example the values of a, b, c is 1 , 8 , 5 then the value of $X_a = 40$ and the values of a, b, c is 2,1,3 then the value X_b of 6 . The above two equations have more than solutions at any time.(i.e.) suppose we give the values of a, b, c as 4,2,5 then the value of X =40.

Therefore more than one solution exists for a given equation .we are restricting the factors of the equation by choosing one of the factors that is known to the programmer

itself and it cannot be easy for the intruder to break. In our example the programmer factors have the value a ,b, c is 1 , 8 , 5 and the intruder factors are a, b, c is 4,2,5 is NOT the same. Even though the values g, n are public, it is now difficult for the intruder to find the private key values X_a and X_b along with correct factors for that equation**.** Since it is difficult for the intruder to workout all possible values for a set of equations to choose the correct one, it is absolutely difficult task to choose the desired one.

User A Using following algorithm as follows:
Choose Private key $x_{a=}$ a *b *c.
Calculate Public Key $y_{a=}$ g^{xa} mod n.
Secret Key $K_1=y_b{}^{xa}$ mod n.
User B Using following algorithm as follows:
Choose Private key x_b= a+b+c.
Public Key $y_{b=}$ g^{xb} mod n.
Secret Key $K_{2=}$ $y_a{}^{xb}$ mod n.
Thus using our own private key generation algorithm it is difficult for the intruder to decide correct factor for the equation that we defined.

4. Experimental Results and Analysis

To test the execution time of our method, we compare the execution time for both normal diffie Hellman algorithm and modified diffie Hellman algorithm

Table 1 General Diffie-Hellman Algorithm Execution Time

X_a	X_b	g	n	Time in (ms)
3	7	5	7	2621961879710
3	5	23	53	2621961594354
7	11	11	13	2621961965370
7	11	17	23	2621962111512
9	11	31	41	2621962202524

Table 2 Modified Diffie-Hellman Algorithm Execution Time

a	b	c	g	n	Time in (ms)
6	7	18	37	529	262212278806
2	17	16	61	449	2622123638752
2	18	16	61	289	2622123756612
2	5	16	61	449	2622123793340
4	6	13	29	377	2622123859782

The execution time for both methods found to be more or less same. Suppose we take a=2,b=5,c=16. At any time intruder recognizes $x_{a=}$160, he has to find correct factor to generate x_a value. There are more than one factor available for above equation x_a=a*b*c. Suppose he give values a=4,b=5,c=8 then value of x_a=160 but he is not able to provide correct factors a=2,b=5,c=16 that is already defined by user.

5. Conclusions and Future Work

This paper proposed a novel diffie Hellman approach. The system defines a method to generate private keys using equations that is defined by user. Experimental results show that the proposed diffie Hellman can work effectively by generating correct factors and it is almost impossible to be crack by intruder. In future, we will test the proposed system with complex equations and to provide a better security mechanism.

References

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