Defend Against Online Password Guessing Attacks

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Abstract—Automated Turing Tests (ATTs) continue to be an effective, easy-to-deploy approach to identify automated malicious login attempts with reasonable cost of inconvenience to users, enabling convenient login for legitimate users while preventing such attacks is a difficult problem. Brute force and dictionary attacks on password-only remote login services are now well-known and ever growing. In this paper, we discuss the drawbacks of existing protocol and proposed a login protocol designed to address large scale online dictionary attacks. PGRP limits the total number of login attempts from unknown remote hosts to as low as a single attempt per username, legitimate users in most cases, We propose a new PAPP (Prevent Attack Password Protocol), derived upon revisiting prior proposals designed to restrict such attacks. The PAPP keeps track of information about the user account and its activities with the help of some data storage lists. PAPP is a new protocol which uses MAC address of machine each login. If MAC address change then user can detect intrusion in between current & previous login. For the password, the proposed system uses the MD5 encryption and decryption method to provide more security to previous approach. The practical work is done under the real time environment to check the performance of this method.

Keyword—ATTs, Brute force attack, Dictionary attack, Online password guessing attacks, PAPP.

I. INTRODUCTION

Online Password Guessing Attacks are the most wide spread and frightening attacks on every browser login and peer to peer systems. Several online attacks include brute force attacks and dictionary attacks. Brute force attacks are those which are occurred by testing every combination of all the possible passwords. Dictionary attacks are those in which all the likely keyword set is formed as a dictionary and compared with the guessed password. For accessing user account user must enter their password and username while login. Each of these transactions are prone to password guessing attacks initiated by remote login systems or bot logins. Many login protocols has been implemented so far to resist such online password guessing attacks. ATTs (Automated Turing Tests) are the common approach used in these protocols to prevent such attacks. They provide secure authentication of username and password in case of remote intrusions as ATTs are capable of detecting human interactions from automated bot logins. Captchas (Completely Automated Public Turing Tests to tell Computers and Human Apart) are the common example for ATTs.

ATTs are used in the assumption that these kinds of challenges are difficult for the bots and easy for most people. But now days there are human solvers and bots which are successful in breaking Captchas. So Captchas are made more complex which are not easily perceivable by users. Therefore the primary aim is to reduce inconvenience to legal users and prevent attackers from attempting remote logins.

There are various kinds of ATT tests like CAPTCHAs (Completely Automated Public Turing Test to tell Computers and Humans Apart), security questions, mobile code verification etc. among which we are using distorted text captcha.

In this paper we propose PAPP protocol in which server insistently rely on MAC address, supplies 3 attempts for login to every client. If 2 attempts are finished then server side notification will be send to registered user. After 3 attempts, user has to face ATT check which contains one security code which server send to legitimate client email address.

PGRP designed to overcome below two categories of attacks:

1. Brute Force Attack: This is kind of attack which is used for guessing online passwords. In this attack different possible code, password or combination is formed until the correct password found. This is very slower kind of attack due to several possible characters combinations in the password. But this attack is effective; and hence given enough time and processing power, all passwords can eventually be identified.

2. Dictionary Attack: Another attack which is frequently used to guess the online passwords using the dictionary of common words in order to crack the end users password successfully. In this the breaking into password protected server by systematically entering every word in a dictionary as a password

A. Organization

In next section II we are presenting the literature survey. In section III, the proposed approach and its system block diagram is depicted. In section IV we are presenting the current state of implementation and results achieved. Finally conclusion and future work is predicted in section V.
II. LITERATURE SURVEY

Although online password guessing attacks have been known from the time of the Internet, there is little scholastic literature on prevention techniques.

- In R. Kirushnaaononi [1] gives defense to online password guessing attacks. It uses PGRP protocol to prevent password from offline or online attacks. In PGRP ,the user when try to login from new machine for very first time will not required to answer ATT test. It means that protocol need very less ATT test. Distorted text based CAPTCHA is used. If ATT test is correctly answered, the user is granted access else the user is denied access.

**Pros**

- Very less ATT test

**Cons**

- Login server will be unable to identify the user in all cases.

- Pinkas and Sander (PS) introduced a protocol that requires answering an ATT challenge first before entering the {username, password} pair. Failing to response the ATT correctly stops the client from proceeding farther. This protocol requires the adversary to overtake an ATT challenge for each password estimating try, in alignment to gain data about correctness of the estimate. While this simple protocol is effective against online dictionary attacks assuming that the utilised ATTs are protected, legitimate users should furthermore overtake an ATT challenge for every login try. Therefore, this protocol affects client convenience considerably, and requires the login server to generate an ATT challenge for every login attempt [2].

**Pros**

- Convenient for user

**Cons**

- No session protection and no intrusion detection.

- Van Oorschot and Stubblebine Protocol is considered to be as an improvement for PS protocol. Only if the clientname, password is incorrect the client is inquired to response an ATT dispute. Else the client is allocated get access to. The number of ATT trials inquired to the client is founded on a threshold value called AskATT(). Sometimes legitimate users may be inquired to answer numerous ATT challenges before being allocated which may annoy the client. Therefore this protocol affects client convenience [3].

**Pros**

- Convenient to user as less ATT test is required.

**Cons**

- No session protection and no intrusion detection.

- Mansour Alsaleh, Mohammad Mannan, and P.C. van Oorschot [4]In this paper they stated PGRP password protecting protocol. In PGRP ,the user when try to login from new machine for very first time will not required to answer ATT test. It means that protocol need very less ATT test. The user when attempting from a new machine for the first time is not required to answer an ATT challenge, if the no. of failed login attempts for a specific username is below a threshold. There are two cases where ATTs are not needed at all. When the no. of failed login attempts for a given username is very small, no ATTs are required. When the remote host has successfully logged in using the same username in the past, no ATTs are required.

**Pros**

- Protects the session information and Tracks down any attempt of unauthorized access

**Cons**

- Requires more time

- In Resmipriya M G, Sangeetha N et.al [6] gives efficient approach to prevent password attacks. It introduced secure session and password protection protocol which ask machine name along with ATT test. If machine name changes then user can detect whether there is intrusion in between current and previous login. The db keeps track of information about the user account and its activities with the help of some data storage lists.

**Pros**

- Protects the session information and Tracks down any attempt of unauthorized access

**Cons**

- Requires more time

- In Delayed Response scheme, the server presents a delayed answer to the client request. This may help in preventing an attacker from ascertaining many passwords in a reasonable time. This design is very effective for localizedized appliances in which a client has to login utilising a physically attached keyboard. It is less productive in a mesh natural environment as the attacker can carry out DoS or DDos strike very efficiently [7].

- One productive protecting against against automated online password estimating attacks is to constraint the number of failed trials without ATTs to a very little number (e.g., three), limiting automated programs (or bots) as utilised by attackers to three free password guesses for a targeted account, even if different appliances from a botnet are used. However, this inconveniences the legitimate client who then must respond an ATT on the next login attempt [10].

III. PROPOSED APPROACH FRAMEWORK AND DESIGN

Our main security goal is to restrict an attacker who is in control of a large botnet from launching online password dictionary attacks. In terms of usability, we want to reduce the number of ATTs sent to legitimate users as much as possible.

In this paper PAPP (Prevent Attack Password Protocol) is presented. Registration is done for new user and all the data is stored in member table. For existing user, login is done using their registered username and password. Password entered by user during registration is encrypted and stored in datatable named member. The PAPP keeps track of information about the user account and its activities with the help of three data storage lists.
White List (W)
The successful login attempts by the user from the particular MAC address for that username is tracked and stored in a data table named White list (W). This storage list includes fields like source MAC address and username.

Failed Login Table (FT)
The failed login attempts from any machine for that username is tracked and stored in a database named Failed login table (FT). This list includes username and failed login attempts for that particular username.

Failed Login Table (FS)
The failed login attempts for that username from a particular MAC address is tracked and stored as {username, MAC} pair in a database named Failed login Table (FS).

This Fig 1. represents the entire system architecture:

![System Architecture](image)

The functional requirements of the system is to defend against the online guessing attacks over the passwords which are been achieved using the PAPP protocol. The requirements are to enter the user name and password for checking authorized user or not. If the user name is correct then the User will be successfully logged in. The Server monitors all details during the communication. If the User misbehaves any Login attempt it will be identified and the misbehaved user will be blocked in the network.

Every user are monitored by the protocol so message transmission will be very clear and very interactive to the Server. If misbehave occur from any user, Server will identify the Misbehaving User or malicious login attempt and avoid that user from the communication progress.

MD5 algorithm is used for encrypting password and storing it in member table. MD5 algorithm is message Digest algorithm. The advantages of this algorithm is that it only encrypt the message it can’t decrypt message to original, so chances of getting original data after guessing the keys are equals to "NO."

In previous system instead of MD5, AES/DES are used but it has several problem that if hacker got keys and if he attack on data base then they can easily get the password, to overcome this problem we use MD5 algorithm.

MD5 algorithm takes input message of arbitrary length and generates 128-bit long output hash.

MD5 hash algorithm consist of 5 steps

1. Append Padding Bits
2. Append Length
3. Initialize MD Buffer
4. Process Message in 16-Word Blocks
5. Output

For better security purpose we are using virtual keyboard to prevent attacks from viruses, Trojan and malware. The programs that might be present in the computer that logs every keystroke from the physical keyboard (keylogger). When user enters username and password at every time there machine information i.e. MAC address, browser history, date and time are goes into database and every time it is been checked by database admin.

B. Algorithm

Input Set:

<table>
<thead>
<tr>
<th>Notations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>u</td>
<td>User name</td>
</tr>
<tr>
<td>p</td>
<td>password</td>
</tr>
<tr>
<td>N(p)</td>
<td>New password</td>
</tr>
<tr>
<td>W</td>
<td>White List</td>
</tr>
<tr>
<td>Ft</td>
<td>Fail Test</td>
</tr>
<tr>
<td>M</td>
<td>Member table</td>
</tr>
<tr>
<td>Fs</td>
<td>Fail list</td>
</tr>
<tr>
<td>MAC</td>
<td>MAC address</td>
</tr>
<tr>
<td>Fc</td>
<td>Fail login count</td>
</tr>
<tr>
<td>∆</td>
<td>Threshold (∆ =3)</td>
</tr>
<tr>
<td>M</td>
<td>Member Table</td>
</tr>
</tbody>
</table>
Process
1. If login (u,p) true Then W={MAC,u}
2. If step 1 fails
   Then Ft={Fc, u}, Fs={MAC,u,Fc}
3. Calculate (Fc, u).
4. If calculate (Fc,u) = Δ true
   Then send N(p) to (u)
5. Go to step 1
6. If (Fc,u) > Δ true
   Then Go to Step 7.
7. Check credential(u)
8. Pass(u) to ATT Test.
9. If step 8 fails
   Then go to step 10.
10. Block(u).

Functions Details
Calculations of Fc:
   If user fails to login then increment Fc by 1 i.e
   Fc = Fc+1, where initially Fc =0;
   When user successfully login to account then decrement Fc by 1, i.e
   Fc= Fc-1.
   And update this Fc to Ft and Fs.

Calculation of N(p):
   We have three sets,
   Str = { as | as A to Z || as a to z }
   Num = {x | 0 < x < 9 and x is real number}
   By combining this two set create new string. For Random selection of Str and Num perform permutation on their respected set. Equation given as follow.
   \[ N(p) = p_{s_{12}}^{\text{Str}} + p_{i_{12}}^{\text{Num}} \]
   where leg = length of password.

Output Set: [Login success, Login Fails, Block account]

In section IV we are presenting the current state of implementation and results achieved.

IV. PRACTICAL RESULTS AND ENVIRONMENT

In this section we are presenting practical environment, dataset used, and metrics computed.

A. Input Dataset
For implementation we use database as My SQL. Data sets were collected and the following results were obtained.
Member log files and User log files have been collected as data sets. Log files have been collected from 20 users. Details like each authentication event, including: username, password, Mobile Number, Email Address, date, time, login status (valid or invalid user), MAC address are collected. Users have been classified as valid and invalid users. Table 1 shows the Member log files and Table 2 shows userlog files

<table>
<thead>
<tr>
<th>TABLE 1 MEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Id</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 2 USERLOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Name</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>Alice</td>
</tr>
<tr>
<td>Bob</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 3 FAIL LIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Name</td>
</tr>
<tr>
<td>-----------</td>
</tr>
</tbody>
</table>
B. Results of Practical Work

Following figure 2 is showing the performance results for experiment work carried. We have compared proposed approach method against the existing methods. Our proposed method i.e. PAPP is very easy to handle for client. At same time if user faces ATT test is much easier as compared to other protocols. As we use MD5 algorithm for password encryption and virtual keyboard to prevent outside attacks, so ultimately our system is more secure than other system. In figure 2, it is showing that proposed method minimizes the failed login attempts to three only as compared to existing methods given there. Also in figure 2, the total valid uniquename entries performances is showing in which with or without performance is varies for methods like VS, PS and PGRP, but for proposed method it doesn’t changes and keeping the same level of security.

Fig.2: Comparisons between password protection protocols.

V. CONCLUSION

Online password estimating attacks on password-only schemes have been discerned for decades. Present day attackers aiming at such systems are empowered by having command of thousand to million-node botnets. In previous ATT-based login protocols, there lives a security usability trade-off with esteem to the number of free failed login attempts (i.e., with no ATTs) versus user login convenience (e.g., less ATTs and other requirements). In contrast, PAPP protocol restricts all internal and outside attacks as we use MD5 encryption algorithm, virtual key board, machines physical address instead of IP address and very ease of use ATT Tests. By considering all this parameters and result we conclude that PAPP gives good security for passwords. In future we further like to extend this method by investigating its performance under real time environment. Scalability investigation is also one promising future direction for this approach.

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REFERENCES

[1] “Defense to curb online password guessing attacks”, R. Kirushnaamoni PG Scholar, Dept. of Computer Science and Engineering, IIEEE.
Revisiting Defenses against Large-Scale Online Password Guessing Attacks Mansour Alsaleh, Mohammad Mannan, and P.C. van Oorschot, Member, IEEE.


