Linux Lab Assignment: Implementing Security Monitoring and Auditing

Part 1: Configuring Linux Logging and Auditing
Configuring comprehensive logging and auditing on a Linux system to monitor security-relevant events

Deliverables:

- Screenshot showing the configuration of rsyslog

sudo apt update

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo apt update
[sudo] password for icdfa:
Get:2 https://artifacts.elastic.co/packages/8.x/apt stable InRelease [3,248 B]
Get:3 https://artifacts.elastic.co/packages/8.x/apt stable/main amd64 Packages [87.9 kB]
Get:1 http://kali.download/kali kali-rolling InRelease [41.5 kB]
Get:4 http://kali.download/kali kali-rolling/main i386 Packages [20.7 MB]
Get:5 http://kali.download/kali kali-rolling/main amd64 Packages [21.2 MB]
Get:6 http://kali.download/kali kali-rolling/main amd64 Contents (deb) [51.8 MB]
Get:7 http://kali.download/kali kali-rolling/main i386 Contents (deb) [48.1 MB]
Get:8 http://kali.download/kali kali-rolling/contrib i386 Packages [99.2 kB]
Get:9 http://kali.download/kali kali-rolling/contrib amd64 Packages [120 kB]
Get:10 http://kali.download/kali kali-rolling/contrib amd64 Contents (deb) [326 kB]
Get:11 http://kali.download/kali kali-rolling/contrib i386 Contents (deb) [182 kB]
Get:12 http://kali.download/kali kali-rolling/non-free i386 Packages [149 kB]
Get:13 http://kali.download/kali kali-rolling/non-free amd64 Packages [200 kB]
Get:14 http://kali.download/kali kali-rolling/non-free amd64 Contents (deb) [911 kB]
Get:15 http://kali.download/kali kali-rolling/non-free i386 Contents (deb) [859 kB]
Get:16 http://kali.download/kali kali-rolling/non-free-firmware amd64 Packages [11.3 kB]
Get:17 http://kali.download/kali kali-rolling/non-free-firmware i386 Packages [10.8 kB]
Get:18 http://kali.download/kali kali-rolling/non-free-firmware amd64 Contents (deb) [28.4 kB]
Get:19 http://kali.download/kali kali-rolling/non-free-firmware i386 Contents (deb) [28.4 kB]
Fetched 145 MB in 10min 37s (227 kB/s)
1404 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

sudo apt install -y rsyslog

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo apt install -y rsyslog
The following packages were automatically installed and are no longer required:
  libcaes1     libevtx1t64    libolecf1      python3-acstore        python3-libcreg   python3-libfwsi    python3-libscca    python3-zstd
  libcreg1t64  libfwsi1t64    libopenh264-7  python3-cffi           python3-libesedb  python3-liblnk     python3-pefile
  libdnnl3     libglapi-mesa  libscca1t64    python3-elasticsearch  python3-libevt    python3-libmsiecf  python3-pycaes
  libevt1t64   libmsiecf1t64  libxnnpack0    python3-flor           python3-libevtx   python3-libolecf   python3-pycparser
Use 'sudo apt autoremove' to remove them.

Installing:
  rsyslog

Installing dependencies:
  libestr0  libfastjson4  liblognorm5

Suggested packages:
  rsyslog-doc      rsyslog-mongodb        rsyslog-hiredis     rsyslog-docker      | rsyslog-gnutls
  rsyslog-mysql    rsyslog-elasticsearch  rsyslog-snmp        rsyslog-clickhouse  rsyslog-gssapi
  | rsyslog-pgsql  rsyslog-kafka          rsyslog-kubernetes  rsyslog-openssl     rsyslog-relp

Summary:
  Upgrading: 0, Installing: 4, Removing: 0, Not Upgrading: 1404
  Download size: 866 kB
  Space needed: 2,343 kB / 4,693 MB available

Get:1 http://kali.download/kali kali-rolling/main amd64 libestr0 amd64 0.1.11-2 [9,048 B]
Get:2 http://kali.download/kali kali-rolling/main amd64 libfastjson4 amd64 1.2304.0-2 [28.9 kB]
Get:3 http://kali.download/kali kali-rolling/main amd64 liblognorm5 amd64 2.0.6-5 [66.5 kB]
Get:4 http://kali.download/kali kali-rolling/main amd64 rsyslog amd64 8.2506.0-4 [762 kB]
Fetched 866 kB in 4s (222 kB/s)
Selecting previously unselected package libestr0:amd64.
(Reading database ... 417547 files and directories currently installed.)
Preparing to unpack .../libestr0_0.1.11-2_amd64.deb ...
Unpacking libestr0:amd64 (0.1.11-2) ...
Selecting previously unselected package libfastjson4:amd64.
Preparing to unpack .../libfastjson4_1.2304.0-2_amd64.deb ...
Unpacking libfastjson4:amd64 (1.2304.0-2) ...
Selecting previously unselected package liblognorm5:amd64.
Preparing to unpack .../liblognorm5_2.0.6-5_amd64.deb ...
Unpacking liblognorm5:amd64 (2.0.6-5) ...
Selecting previously unselected package rsyslog.
Preparing to unpack .../rsyslog_8.2506.0-4_amd64.deb ...
Unpacking rsyslog (8.2506.0-4) ...
Setting up libestr0:amd64 (0.1.11-2) ...
Setting up libfastjson4:amd64 (1.2304.0-2) ...
Setting up liblognorm5:amd64 (2.0.6-5) ...
Setting up rsyslog (8.2506.0-4) ...
Created symlink '/etc/systemd/system/syslog.service' → '/usr/lib/systemd/system/rsyslog.service'.
Created symlink '/etc/systemd/system/multi-user.target.wants/rsyslog.service' → '/usr/lib/systemd/system/rsyslog.service'.
Processing triggers for kali-menu (2025.1.1) ...
Processing triggers for libc-bin (2.41-6) ...
Processing triggers for man-db (2.13.0-1) ...
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo nano /etc/rsyslog.d/security.config
[sudo] password for icdfa:

┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl restart rsyslog

┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl status rsyslog
● rsyslog.service - System Logging Service
     Loaded: loaded (/usr/lib/systemd/system/rsyslog.service; enabled; preset: enabled)
     Active: active (running) since Fri 2025-09-12 22:46:29 WAT; 16s ago
 Invocation: 998da4ca145348adaae7d67487a4e5e7
TriggeredBy: ● syslog.socket
       Docs: man:rsyslogd(8)
             man:rsyslog.conf(5)
             https://www.rsyslog.com/doc/
   Main PID: 416182 (rsyslogd)
      Tasks: 4 (limit: 2207)
     Memory: 1.2M (peak: 2.4M)
        CPU: 62ms
     CGroup: /system.slice/rsyslog.service
             └─416182 /usr/sbin/rsyslogd -n -iNONE

Sep 12 22:46:29 icdfa systemd[1]: Starting rsyslog.service - System Logging Service...
Sep 12 22:46:29 icdfa rsyslogd[416182]: imuxsock: Acquired UNIX socket '/run/systemd/journal/syslog' (fd 3) from syst>
Sep 12 22:46:29 icdfa systemd[1]: Started rsyslog.service - System Logging Service.
Sep 12 22:46:29 icdfa rsyslogd[416182]: [origin software="rsyslogd" swVersion="8.2506.0" x-pid="416182" x-info="https>
lines 1-19/19 (END)
```

Creating a security logging configuration and restarting rsyslog to apply changes.

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo tee /etc/rsyslog.d/security.conf > /dev/null << 'EOF'
# Log authentication messages to auth.log
auth,authpriv.*                 /var/log/auth.log

# Log kernel messages to kern.log
kern.*                          /var/log/kern.log

# Create a dedicated security log file
if $programname == 'sudo' or $programname == 'su' or $programname == 'sshd' or $programnam
e == 'firewalld' or $programname == 'fail2ban' then /var/log/security.log
& stop

# Remote logging (uncomment and configure for production use)
# *.* @logserver.example.com:514
EOF
[sudo] password for icdfa:

┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl restart rsyslog
```

- Screenshots showing the configuration of auditd

Install auditd

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo apt install -y auditd audispd-plugins
The following packages were automatically installed and are no longer required:
  libcaes1       libolecf1              python3-libcreg    python3-libscca
  libcreg1t64    libopenh264-7          python3-libesedb   python3-pefile
  libdnnl3       libscca1t64            python3-libevt     python3-pycaes
  libevt1t64     libxnnpack0            python3-libevtx    python3-pycparser
  libevtx1t64    python3-acstore        python3-libfwsi    python3-zstd
  libfwsi1t64    python3-cffi           python3-liblnk
  libglapi-mesa  python3-elasticsearch  python3-libmsiecf
  libmsiecf1t64  python3-flor           python3-libolecf
Use 'sudo apt autoremove' to remove them.

Upgrading:
  libaudit-common  libaudit1

Installing:
  audispd-plugins  auditd

Installing dependencies:
  libauparse0t64

Summary:
  Upgrading: 2, Installing: 3, Removing: 0, Not Upgrading: 1395
  Download size: 418 kB
  Space needed: 1,148 kB / 4,681 MB available

Get:1 http://kali.download/kali kali-rolling/main amd64 libaudit-common all 1:4.0.5-1 [13.
5 kB]
Get:2 http://kali.download/kali kali-rolling/main amd64 libaudit1 amd64 1:4.0.5-1 [59.4 kB
]
Get:3 http://kali.download/kali kali-rolling/main amd64 libauparse0t64 amd64 1:4.0.5-1 [70
.1 kB]
Get:4 http://kali.download/kali kali-rolling/main amd64 auditd amd64 1:4.0.5-1 [225 kB]
Get:5 http://kali.download/kali kali-rolling/main amd64 audispd-plugins amd64 1:4.0.5-1 [4
9.4 kB]
Fetched 418 kB in 5s (84.9 kB/s)
(Reading database ... 417824 files and directories currently installed.)
Preparing to unpack .../libaudit-common_1%3a4.0.5-1_all.deb ...
Unpacking libaudit-common (1:4.0.5-1) over (1:4.0.2-2) ...
Setting up libaudit-common (1:4.0.5-1) ...
(Reading database ... 417824 files and directories currently installed.)
Preparing to unpack .../libaudit1_1%3a4.0.5-1_amd64.deb ...
Unpacking libaudit1:amd64 (1:4.0.5-1) over (1:4.0.2-2+b1) ...
Setting up libaudit1:amd64 (1:4.0.5-1) ...
Selecting previously unselected package libauparse0t64:amd64.
(Reading database ... 417823 files and directories currently installed.)
Preparing to unpack .../libauparse0t64_1%3a4.0.5-1_amd64.deb ...
Adding 'diversion of /lib/x86_64-linux-gnu/libauparse.so.0 to /lib/x86_64-linux-gnu/libaup
arse.so.0.usr-is-merged by libauparse0t64'
Adding 'diversion of /lib/x86_64-linux-gnu/libauparse.so.0.0.0 to /lib/x86_64-linux-gnu/li
bauparse.so.0.0.0.usr-is-merged by libauparse0t64'
Unpacking libauparse0t64:amd64 (1:4.0.5-1) ...
Selecting previously unselected package auditd.
Preparing to unpack .../auditd_1%3a4.0.5-1_amd64.deb ...
Unpacking auditd (1:4.0.5-1) ...
Selecting previously unselected package audispd-plugins.
Preparing to unpack .../audispd-plugins_1%3a4.0.5-1_amd64.deb ...
Unpacking audispd-plugins (1:4.0.5-1) ...
Setting up libauparse0t64:amd64 (1:4.0.5-1) ...
Setting up auditd (1:4.0.5-1) ...
update-rc.d: We have no instructions for the auditd init script.
update-rc.d: It looks like a non-network service, we enable it.
audit-rules.service is a disabled or a static unit, not starting it.
auditd.service is a disabled or a static unit, not starting it.
Setting up audispd-plugins (1:4.0.5-1) ...
Processing triggers for libc-bin (2.41-6) ...
Processing triggers for man-db (2.13.0-1) ...
Processing triggers for kali-menu (2025.1.1) ...
```

Create a comprehensive audit configuration

```
┌──(icdfa㉿icdfa)-[~]
└─$ >....
-w /etc/security/opasswd -p wa -k identity

# Monitor system authentication
-w /etc/pam.d/ -p wa -k system-auth
-w /etc/nsswitch.conf -p wa -k system-auth
-w /etc/ssh/sshd_config -p wa -k system-auth

# Monitor system calls
-a always,exit -F arch=b64 -S execve -k exec
-a always,exit -F arch=b32 -S execve -k exec

# Monitor privileged commands
-a always,exit -F path=/usr/bin/sudo -F perm=x -k privileged
-a always,exit -F path=/usr/bin/su -F perm=x -k privileged
-a always,exit -F path=/usr/bin/passwd -F perm=x -k privileged
-a always,exit -F path=/usr/bin/chage -F perm=x -k privileged
-a always,exit -F path=/usr/bin/gpasswd -F perm=x -k privileged
-a always,exit -F path=/usr/bin/chsh -F perm=x -k privileged
-a always,exit -F path=/usr/bin/mount -F perm=x -k privileged
-a always,exit -F path=/usr/bin/umount -F perm=x -k privileged

# Monitor sensitive directories
-w /etc/ -p wa -k system-config
-w /var/log/ -p wa -k log-write
-w /usr/bin/ -p wa -k binary-modification
-w /usr/sbin/ -p wa -k binary-modification
-w /bin/ -p wa -k binary-modification
-w /sbin/ -p wa -k binary-modification

# Monitor unsuccessful events
-a always,exit -F arch=b64 -S open,openat,open_by_handle_at -F exit=-EACCES -k access
-a always,exit -F arch=b32 -S open,openat,open_by_handle_at -F exit=-EACCES -k access
-a always,exit -F arch=b64 -S open,openat,open_by_handle_at -F exit=-EPERM -k access
-a always,exit -F arch=b32 -S open,openat,open_by_handle_at -F exit=-EPERM -k access

# Make the configuration immutable - requires reboot to change
-e 2
EOF
```

Loading the new audit rules

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo auditctl -R /etc/audit/rules.d/security-audit.rules

No rules
enabled 0
failure 1
pid 0
rate_limit 0
backlog_limit 8192
lost 0
backlog 0
backlog_wait_time 15000
backlog_wait_time_actual 0
enabled 0
failure 1
pid 0
rate_limit 0
backlog_limit 8192
lost 0
backlog 0
backlog_wait_time 15000
backlog_wait_time_actual 0
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
perm used without an arch is slower
perm used without an arch is slower
perm used without an arch is slower
perm used without an arch is slower
perm used without an arch is slower
perm used without an arch is slower
perm used without an arch is slower
perm used without an arch is slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
Old style watch rules are slower
enabled 2
failure 1
pid 0
rate_limit 0
backlog_limit 8192
lost 0
backlog 0
backlog_wait_time 15000
backlog_wait_time_actual 0
```

Enabling the audit service

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl enable auditd
Synchronizing state of auditd.service with SysV service script with /usr/lib/systemd/systemd
-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable auditd
Created symlink '/etc/systemd/system/multi-user.target.wants/auditd.service' → '/usr/lib/sys
temd/system/auditd.service'.
```

starting the audit service

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl restart auditd
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo auditctl -l
[sudo] password for icdfa:
-w /etc/passwd -p wa -k identity
-w /etc/group -p wa -k identity
-w /etc/shadow -p wa -k identity
-w /etc/gshadow -p wa -k identity
-w /etc/security/opasswd -p wa -k identity
-w /etc/pam.d -p wa -k system-auth
-w /etc/nsswitch.conf -p wa -k system-auth
-w /etc/ssh/sshd_config -p wa -k system-auth
-a always,exit -F arch=b64 -S execve -F key=exec
-a always,exit -F arch=b32 -S execve -F key=exec
-w /usr/bin/sudo -p x -k privileged
-w /usr/bin/su -p x -k privileged
-w /usr/bin/passwd -p x -k privileged
-w /usr/bin/chage -p x -k privileged
-w /usr/bin/gpasswd -p x -k privileged
-w /usr/bin/chsh -p x -k privileged
-w /usr/bin/mount -p x -k privileged
-w /usr/bin/umount -p x -k privileged
-w /etc -p wa -k system-config
-w /var/log -p wa -k log-write
-w /usr/bin -p wa -k binary-modification
-w /usr/sbin -p wa -k binary-modification
-w /bin -p wa -k binary-modification
-w /sbin -p wa -k binary-modification
-a always,exit -F arch=b64 -S open,openat,open_by_handle_at -F exit=-EACCES -F key=access
-a always,exit -F arch=b32 -S open,openat,open_by_handle_at -F exit=-EACCES -F key=access
-a always,exit -F arch=b64 -S open,openat,open_by_handle_at -F exit=-EPERM -F key=access
-a always,exit -F arch=b32 -S open,openat,open_by_handle_at -F exit=-EPERM -F key=access
```

Configuring log rotation to ensure logs are properly managed by creating a custom log rotation configuration for security logs

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo tee /etc/logrotate.d/security > /dev/null << 'EOF'
/var/log/auth.log
/var/log/kern.log
/var/log/security.log
/var/log/audit/audit.log {
    rotate 14
    daily
    missingok
    notifempty
    compress
    delaycompress
    sharedscripts
    postrotate
        /usr/lib/rsyslog/rsyslog-rotate
        systemctl restart auditd >/dev/null 2>&1 || true
    endscript
    create 0640 root adm
}
EOF

┌──(icdfa㉿icdfa)-[~]
└─$
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo logrotate -d /etc/logrotate.d/security
warning: logrotate in debug mode does nothing except printing debug messages!  Consider using verbose mode (-v) instea
d if this is not what you want.

reading config file /etc/logrotate.d/security
Reading state from file: /var/lib/logrotate/status
Allocating hash table for state file, size 64 entries
Creating new state
Creating new state
Creating new state
Creating new state
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Creating new state

Handling 1 logs

rotating pattern: /var/log/auth.log
/var/log/kern.log
/var/log/security.log
/var/log/audit/audit.log after 1 days empty log files are not rotated, (14 rotations), old logs are removed
considering log /var/log/auth.log
Creating new state
  Now: 2025-09-12 23:15
  Last rotated at 2025-09-12 23:00
  log does not need rotating (log has already been rotated)
considering log /var/log/kern.log
Creating new state
  Now: 2025-09-12 23:15
  Last rotated at 2025-09-12 23:00
  log does not need rotating (log has already been rotated)
considering log /var/log/security.log
Creating new state
  Now: 2025-09-12 23:15
  Last rotated at 2025-09-12 23:00
  log does not need rotating (log has already been rotated)
considering log /var/log/audit/audit.log
Creating new state
  Now: 2025-09-12 23:15
  Last rotated at 2025-09-12 23:00
  log does not need rotating (log has already been rotated)
not running postrotate script, since no logs were rotated

┌──(icdfa㉿icdfa)-[~]
└─$
```

- Screenshots showing the configuration of Fail2ban

Install Fail2ban

Creating a custom Fail2ban configuration

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo tee /etc/fail2ban/jail.local > /dev/null << 'EOF'
[DEFAULT]
# Ban hosts for 1 hour
bantime = 3600
# Check for new failed login attempts every 10 minutes
findtime = 600
# Ban after 5 failed login attempts
maxretry = 5
# Email to send notifications to (change to your email)
destemail = admin@example.com
# Email sender
sender = fail2ban@example.com
# Action to take when banning
action = %(action_mwl)s

[sshd]
enabled = true
port = ssh
filter = sshd
logpath = /var/log/auth.log

[sshd-ddos]
enabled = true
port = ssh
filter = sshd-ddos
logpath = /var/log/auth.log

[sudo]
enabled = true
filter = sudo
logpath = /var/log/auth.log
maxretry = 3
EOF
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ cat /etc/fail2ban/jail.local
[DEFAULT]
# Ban hosts for 1 hour
bantime = 3600
# Check for new failed login attempts every 10 minutes
findtime = 600
# Ban after 5 failed login attempts
maxretry = 5
# Email to send notifications to (change to your email)
destemail = admin@example.com
# Email sender
sender = fail2ban@example.com
# Action to take when banning
action = %(action_mwl)s

[sshd]
enabled = true
port = ssh
filter = sshd
logpath = /var/log/auth.log

[sshd-ddos]
enabled = true
port = ssh
filter = sshd-ddos
logpath = /var/log/auth.log

[sudo]
enabled = true
filter = sudo
logpath = /var/log/auth.log
maxretry = 3
```

Enabling and start Fail2ban

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl enable fail2ban
Synchronizing state of fail2ban.service with SysV service script with /usr/lib/systemd/syste
md-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable fail2ban
Created symlink '/etc/systemd/system/multi-user.target.wants/fail2ban.service' → '/usr/lib/s
ystemd/system/fail2ban.service'.

┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl restart fail2ban
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo systemctl status fail2ban
● fail2ban.service - Fail2Ban Service
     Loaded: loaded (/usr/lib/systemd/system/fail2ban.service; enabled; preset: disabled)
     Active: active (running) since Fri 2025-09-12 18:56:50 WAT; 4h 25min ago
 Invocation: 029a4cb2cf864dcba7f52de9ea530543
       Docs: man:fail2ban(1)
   Main PID: 15837 (fail2ban-server)
      Tasks: 5 (limit: 2207)
     Memory: 13.4M (peak: 28.1M, swap: 1.5M, swap peak: 1.5M)
        CPU: 11.124s
     CGroup: /system.slice/fail2ban.service
             └─15837 /usr/bin/python3 /usr/bin/fail2ban-server -xf start

Sep 12 18:56:50 icdfa systemd[1]: Started fail2ban.service - Fail2Ban Service.
Sep 12 18:56:50 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2ban.configreader   [15837]: ERROR   Found >
Sep 12 18:56:50 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2ban.jailreader     [15837]: ERROR   Unable>
Sep 12 18:56:50 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2ban.jailsreader    [15837]: ERROR   Errors>
Sep 12 18:56:50 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2ban.configreader   [15837]: ERROR   Found >
Sep 12 18:56:50 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2ban.jailreader     [15837]: ERROR   Unable>
Sep 12 18:56:50 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2ban.jailsreader    [15837]: ERROR   Errors>
Sep 12 18:56:50 icdfa fail2ban-server[15837]: Server ready
```

Verify status

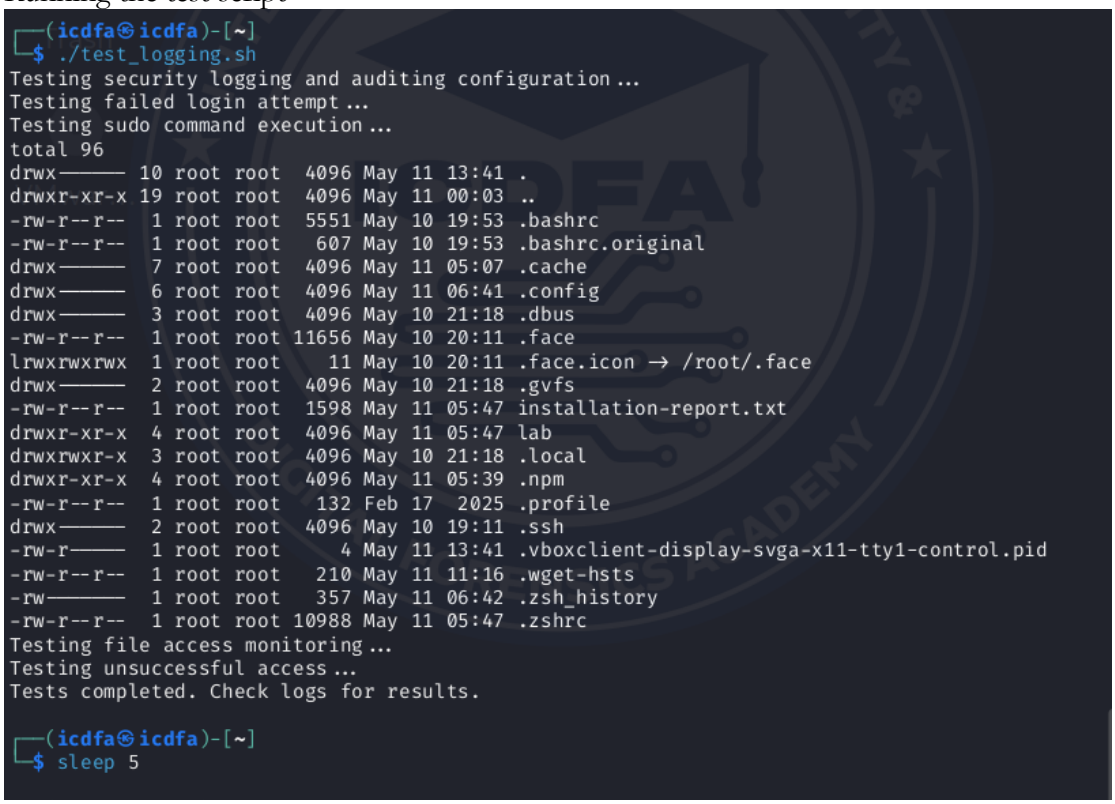
```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo fail2ban-client status sshd
Status for the jail: sshd
├─ Filter
|  ├─ Currently failed: 0
|  ├─ Total failed:     0
|  `- Journal matches:  _SYSTEMD_UNIT=ssh.service + _COMM=sshd
`- Actions
   ├─ Currently banned: 0
   ├─ Total banned:     0
   `- Banned IP list:
```

Creating a script to test the logging and auditing configuration

```
┌──(icdfa㉿icdfa)-[~]
└─$ cat > test_logging.sh << 'EOF'
#!/bin/bash

echo "Testing security logging and auditing configuration..."

# Test authentication logging
echo "Testing failed login attempt..."
ssh -o BatchMode=yes -o ConnectTimeout=5 nonexistentuser@localhost 2>/dev/null || true

# Test sudo logging
echo "Testing sudo command execution..."
sudo ls -la /root

# Test file access monitoring
echo "Testing file access monitoring..."
sudo touch /etc/test_audit_file
sudo rm /etc/test_audit_file

# Test unsuccessful access
echo "Testing unsuccessful access..."
cat /etc/shadow 2>/dev/null || true

echo "Tests completed. Check logs for results."
EOF

┌──(icdfa㉿icdfa)-[~]
└─$ chmod +x test_logging.sh
```

- Output from the test script showing the logging and auditing in action

Running the test script



Collecting the results

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo ausearch -ts today -k access 2>/dev/null
----
time->Fri Sep 12 18:51:12 2025
type=PROCTITLE msg=audit(1757699472.207:5308): proctitle=73657470726976002D2D726575696400 6D616E002D2D7265676964006D616E002D2D696E69742D67726F757073002D2D002F7573722F62696E2F6D616E6462002D7071
type=PATH msg=audit(1757699472.207:5308): item=0 name="/root/.manpath" nametype=UNKNOWN cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(1757699472.207:5308): cwd="/"
type=SYSCALL msg=audit(1757699472.207:5308): arch=c000003e syscall=257 success=no exit=-13 a0=ffffffffffffff9c a1=5567f851c500 a2=0 a3=0 items=1 ppid=12896 pid=12897 auid=1000 uid=6 gid=12 euid=6 suid=6 fsuid=6 egid=12 sgid=12 fsgid=12 tty=pts2 ses=2 comm="mandb" exe="/usr/bin/mandb" subj=unconfined key="access"
----
time->Fri Sep 12 18:58:36 2025
type=PROCTITLE msg=audit(1757699916.267:8130): proctitle=2F7573722F6C6962657865632F6C6F63616C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699916.267:8130): item=0 name="/etc/ld.so.cache" inode=1107594 dev=08:01 mode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(1757699916.267:8130): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699916.267:8130): arch=c000003e syscall=257 success=no exit=-13 a0=ffffff9c a1=7f121197921c a2=80000 a3=0 items=1 ppid=1233 pid=16710 auid=1000 uid=1000 gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2 comm="localsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="access"
----
time->Fri Sep 12 18:58:36 2025
type=PROCTITLE msg=audit(1757699916.271:8131): proctitle=2F7573722F6C6962657865632F6C6F63616C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699916.271:8131): item=0 name="/proc/filesystems" inode=4026532069 dev=00:17 mode=0100444 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(1757699916.271:8131): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699916.271:8131): arch=c000003e syscall=257 success=no exit=-13 a0=ffffffffffffff9c a1=7f12109f1904 a2=80000 a3=0 items=1 ppid=1233 pid=16710 auid=1000 uid=1000 gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2 comm="localsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="access"
----
time->Fri Sep 12 18:58:36 2025
type=PROCTITLE msg=audit(1757699916.283:8132): proctitle=2F7573722F6C6962657865632F6C6F63616C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699916.283:8132): item=0 name="/usr/share/locale/locale.alias" inode=1046639 dev=08:01 mode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(1757699916.283:8132): cwd="/home/icdfa"
```

```
type=SYSCALL msg=audit(1757699916.367:8133): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffffffffffff9c a1=7f1210a5c855 a2=80000 a3=0 items=1 ppid=1233 pid=16710 auid=1000 uid=1
000 gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2
comm="localsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="acces
s"
----
time->Fri Sep 12 18:58:36 2025
type=PROCTITLE msg=audit(1757699916.371:8134): proctitle=2F7573722F6C6962657865632F6C6F63616
C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699916.371:8134): item=0 name="/etc/nsswitch.conf" inode=1104645 dev
=08:01 mode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_
fver=0 cap_frootid=0
type=CWD msg=audit(1757699916.371:8134): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699916.371:8134): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffff9c a1=7f12113ee7f1 a2=80000 a3=0 items=1 ppid=1233 pid=16710 auid=1000 uid=1000 gid=
1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2 comm="lo
calsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="access"
----
time->Fri Sep 12 18:58:55 2025
type=PROCTITLE msg=audit(1757699935.323:8251): proctitle=2F7573722F6C6962657865632F6C6F63616
C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699935.323:8251): item=0 name="/etc/ld.so.cache" inode=1107594 dev=0
8:01 mode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fv
er=0 cap_frootid=0
type=CWD msg=audit(1757699935.323:8251): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699935.323:8251): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffff9c a1=7f2cb17a221c a2=80000 a3=0 items=1 ppid=1233 pid=16872 auid=1000 uid=1000 gid=
1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2 comm="lo
calsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="access"
----
time->Fri Sep 12 18:58:55 2025
type=PROCTITLE msg=audit(1757699935.331:8252): proctitle=2F7573722F6C6962657865632F6C6F63616
C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699935.331:8252): item=0 name="/proc/filesystems" inode=4026532069 d
ev=00:17 mode=0100444 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 ca
p_fver=0 cap_frootid=0
type=CWD msg=audit(1757699935.331:8252): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699935.331:8252): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffffffffffff9c a1=7f2cb0fd4904 a2=80000 a3=0 items=1 ppid=1233 pid=16872 auid=1000 uid=1
000 gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2
comm="localsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="acces
s"
----
```

```
time→Fri Sep 12 18:58:55 2025
type=PROCTITLE msg=audit(1757699935.331:8253): proctitle=2F7573722F6C6962657865632F6C6F63616
C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699935.331:8253): item=0 name="/usr/share/locale/locale.alias" inode
=1046639 dev=08:01 mode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 c
ap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(1757699935.331:8253): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699935.331:8253): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffff9c a1=7fffe8311b80 a2=80000 a3=0 items=1 ppid=1233 pid=16872 auid=1000 uid=1000 gid=
1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2 comm="lo
calsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="access"
———
time→Fri Sep 12 18:58:55 2025
type=PROCTITLE msg=audit(1757699935.407:8254): proctitle=2F7573722F6C6962657865632F6C6F63616
C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699935.407:8254): item=0 name="/etc/fstab" inode=1046531 dev=08:01 m
ode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0 c
ap_frootid=0
type=CWD msg=audit(1757699935.407:8254): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699935.407:8254): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffffffffffff9c a1=7f2cb085c855 a2=80000 a3=0 items=1 ppid=1233 pid=16872 auid=1000 uid=1
000 gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2
comm="localsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="acces
s"
———
time→Fri Sep 12 18:58:55 2025
type=PROCTITLE msg=audit(1757699935.411:8255): proctitle=2F7573722F6C6962657865632F6C6F63616
C7365617263682D657874726163746F722D33002D2D736F636B65742D66640033
type=PATH msg=audit(1757699935.411:8255): item=0 name="/etc/nsswitch.conf" inode=1104645 dev
=08:01 mode=0100644 ouid=0 ogid=0 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_
fver=0 cap_frootid=0
type=CWD msg=audit(1757699935.411:8255): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757699935.411:8255): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffff9c a1=7f2cb12177f1 a2=80000 a3=0 items=1 ppid=1233 pid=16872 auid=1000 uid=1000 gid=
1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=(none) ses=2 comm="lo
calsearch-ext" exe="/usr/libexec/localsearch-extractor-3" subj=unconfined key="access"
———
time→Fri Sep 12 19:01:28 2025
type=PROCTITLE msg=audit(1757700088.967:9260): proctitle=636174002F6574632F736861646F77
type=PATH msg=audit(1757700088.967:9260): item=0 name="/etc/shadow" inode=1046852 dev=08:01
mode=0100640 ouid=0 ogid=42 rdev=00:00 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0
 cap_frootid=0
type=CWD msg=audit(1757700088.967:9260): cwd="/home/icdfa"
type=SYSCALL msg=audit(1757700088.967:9260): arch=c000003e syscall=257 success=no exit=-13 a
0=ffffffffffffff9c a1=7ffd736f4207 a2=0 a3=0 items=1 ppid=18233 pid=18247 auid=1000 uid=1000
 gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=pts0 ses=2 comm=
"cat" exe="/usr/bin/cat" subj=unconfined key="access"

┌──(icdfa㉿icdfa)-[~]
└─$ sudo ausearch -ts today -k privileged 2>/dev/null

┌──(icdfa㉿icdfa)-[~]
└─$ echo "Fail2ban log entries:"
Fail2ban log entries:

┌──(icdfa㉿icdfa)-[~]
└─$ sudo grep -i "fail2ban" /var/log/syslog | tail -10
2025-09-12T18:56:50.298528+01:00 icdfa systemd[1]: Started fail2ban.service - Fail2Ban Servi
ce.
2025-09-12T18:56:50.537040+01:00 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2
ban.configreader   [15837]: ERROR   Found no accessible config files for 'filter.d/sshd-ddos
' under /etc/fail2ban
2025-09-12T18:56:50.537189+01:00 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2
ban.jailreader     [15837]: ERROR   Unable to read the filter 'sshd-ddos'
2025-09-12T18:56:50.537217+01:00 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2
ban.jailsreader    [15837]: ERROR   Errors in jail 'sshd-ddos'. Skipping...
2025-09-12T18:56:50.537241+01:00 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2
ban.configreader   [15837]: ERROR   Found no accessible config files for 'filter.d/sudo' und
er /etc/fail2ban
2025-09-12T18:56:50.537265+01:00 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2
ban.jailreader     [15837]: ERROR   Unable to read the filter 'sudo'
2025-09-12T18:56:50.537289+01:00 icdfa fail2ban-server[15837]: 2025-09-12 18:56:50,534 fail2
ban.jailsreader    [15837]: ERROR   Errors in jail 'sudo'. Skipping...
2025-09-12T18:56:50.615090+01:00 icdfa fail2ban-server[15837]: Server ready
```

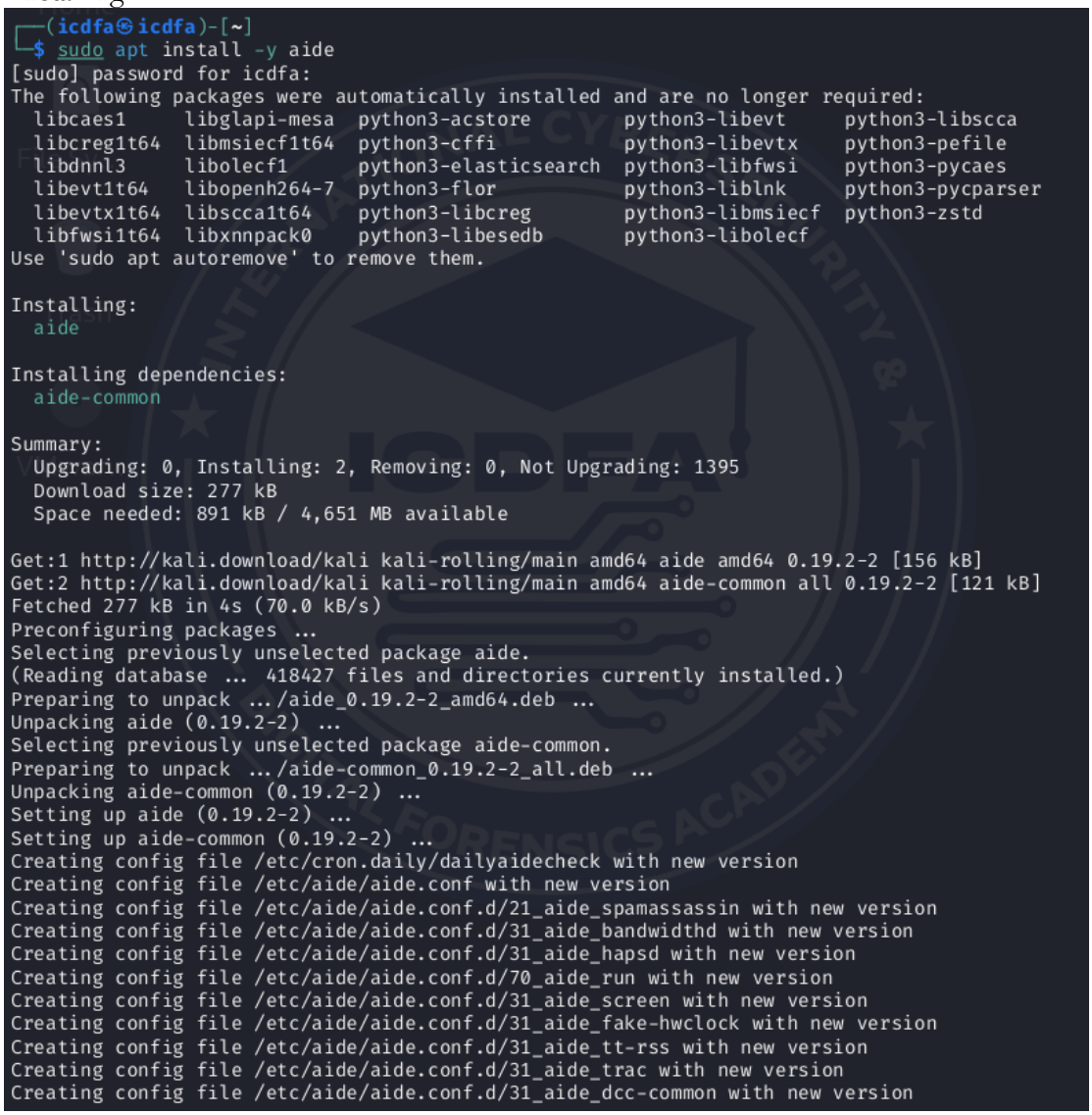
- These logging and auditing mechanisms are often used to support security governance through insight provision of the current state of the system, which in turn supports the security frameworks that are built to support security governance.

Part 2: Implementing Security Monitoring Tools

Deliverables:

- Screenshots showing the installation and configuration of AIDE

Installing AIDE



```
Creating config file /etc/aide/aide.conf.d/31_aide_inn2 with new version
Creating config file /etc/aide/aide.conf.d/31_aide_run_systemd_netif with new version
Creating config file /etc/aide/aide.conf.d/31_aide_postfix with new version
Creating config file /etc/aide/aide.conf.d/31_aide_valkey with new version
Creating config file /etc/aide/aide.conf.d/31_aide_dbus with new version
Creating config file /etc/aide/aide.conf.d/31_aide_udev with new version
Creating config file /etc/aide/aide.conf.d/31_aide_pam_motd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_php-fpm with new version
Creating config file /etc/aide/aide.conf.d/31_aide_anubis with new version
Creating config file /etc/aide/aide.conf.d/31_aide_tiger with new version
Creating config file /etc/aide/aide.conf.d/31_aide_console-setup with new version
Creating config file /etc/aide/aide.conf.d/31_aide_vsftpd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_apache2 with new version
Creating config file /etc/aide/aide.conf.d/31_aide_fwupd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_dlocate with new version
Creating config file /etc/aide/aide.conf.d/31_aide_amanda-client with new version
Creating config file /etc/aide/aide.conf.d/31_aide_mysql-server with new version
Creating config file /etc/aide/aide.conf.d/31_aide_uuidd-runtime with new version
Creating config file /etc/aide/aide.conf.d/31_aide_man with new version
Creating config file /etc/aide/aide.conf.d/31_aide_locales with new version
Creating config file /etc/aide/aide.conf.d/10_aide_bits with new version
Creating config file /etc/aide/aide.conf.d/31_aide_xe-guest-utilities with new version
Creating config file /etc/aide/aide.conf.d/31_aide_proftpd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_amanda-server with new version
Creating config file /etc/aide/aide.conf.d/31_aide_logcheck with new version
Creating config file /etc/aide/aide.conf.d/31_aide_unbound with new version
Creating config file /etc/aide/aide.conf.d/31_aide_apt-cacher-ng with new version
Creating config file /etc/aide/aide.conf.d/31_aide_gnupg with new version
Creating config file /etc/aide/aide.conf.d/31_aide_dmeventd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_mlocate with new version
Creating config file /etc/aide/aide.conf.d/70_aide_var with new version
Creating config file /etc/aide/aide.conf.d/31_aide_systemd-networkd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_privoxy with new version
Creating config file /etc/aide/aide.conf.d/31_aide_util-linux with new version
Creating config file /etc/aide/aide.conf.d/31_aide_libapache2-mod-fastcgi with new version
Creating config file /etc/aide/aide.conf.d/31_aide_snmpd with new version
Creating config file /etc/aide/aide.conf.d/31_aide_cron-apt with new version
Creating config file /etc/aide/aide.settings.d/31_aide_trac_settings with new version
Creating config file /etc/aide/aide.settings.d/10_aide_sourceslist with new version
Creating config file /etc/aide/aide.settings.d/31_aide_svn-server_settings with new version
Creating config file /etc/aide/aide.settings.d/31_aide_apt_settings with new version
Creating config file /etc/aide/aide.settings.d/31_aide_torrus_settings with new version
Creating config file /etc/default/aide with new version
Creating group '_aide' with GID 990.
Creating user '_aide' (Advanced Intrusion Detection Environment) with UID 990 and GID 990.
Created symlink '/etc/systemd/system/timers.target.wants/dailyaidecheck.timer' → '/usr/lib/s
ystemd/system/dailyaidecheck.timer'.
dailyaidecheck.service is a disabled or a static unit, not starting it.
dailyaidecheck-buildcache.service is a disabled or a static unit, not starting it.
dailyaidecheck-buildcache.service is a disabled or a static unit, not starting it.
dailyaidecheck.service is a disabled or a static unit, not starting it.
Processing triggers for man-db (2.13.0-1) ...
Processing triggers for kali-menu (2025.1.1) ...

┌──(icdfa㉿icdfa)-[~]
└─$
```

Creating a custom AIDE configuration

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo tee /etc/aide/aide.conf.d/90_custom.conf > /dev/null << 'EOF'
# Define custom rules
Binaries = p+i+n+u+g+s+b+m+c+sha1+sha256+rmd160
Logs = p+i+n+u+g+S
ConfigFiles = p+i+n+u+g+s+b+m+c+sha1+sha256+rmd160

# Monitor specific directories
/bin Binaries
/sbin Binaries
/usr/bin Binaries
/usr/sbin Binaries
/etc ConfigFiles
/var/log Logs
EOF
```

Initializing the AIDE database

Moving the new database into place

Create a daily check script

- Screenshots showing the installation and configuration of Lynis

Installing Lynis

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo apt install -y lynis
[sudo] password for icdfa:
lynis is already the newest version (3.1.4-1).
The following packages were automatically installed and are no longer required:
  libcaes1      libglapi-mesa  python3-acstore        python3-libevt     python3-libscca
  libcreg1t64   libmsiecf1t64  python3-cffi           python3-libevtx    python3-pefile
  libdnnl3      libolecf1      python3-elasticsearch  python3-libfwsi    python3-pycaes
  libevt1t64    libopenh264-7  python3-flor           python3-liblnk     python3-pycparser
  libevtx1t64   libscca1t64    python3-libcreg        python3-libmsiecf  python3-zstd
  libfwsi1t64   libxnnpack0    python3-libesedb       python3-libolecf
Use 'sudo apt autoremove' to remove them.

Summary:
  Upgrading: 0, Installing: 0, Removing: 0, Not Upgrading: 1395
```

Running a system audit

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo lynis audit system --quick

[ Lynis 3.1.4 ]

################################################################################
  Lynis comes with ABSOLUTELY NO WARRANTY. This is free software, and you are
  welcome to redistribute it under the terms of the GNU General Public License.
  See the LICENSE file for details about using this software.

  2007-2024, CISOfy - https://cisofy.com/lynis/
  Enterprise support available (compliance, plugins, interface and tools)
################################################################################


[+] Initializing program
------------------------------------
  - Detecting OS...                                           [ DONE ]
  - Checking profiles...                                      [ DONE ]

  ---------------------------------------------------
  Program version:           3.1.4
  Operating system:          Linux
  Operating system name:     Kali Linux
  Operating system version:  Rolling release
  Kernel version:            6.12.13
  Hardware platform:         x86_64
  Hostname:                  icdfa
  ---------------------------------------------------
  Profiles:                  /etc/lynis/default.prf
  Log file:                  /var/log/lynis.log
  Report file:               /var/log/lynis-report.dat
  Report version:            1.0
  Plugin directory:          /etc/lynis/plugins
  ---------------------------------------------------
  Auditor:                   [Not Specified]
  Language:                  en
  Test category:             all
  Test group:                all
  ---------------------------------------------------
  - Program update status...                                  [ NO UPDATE ]
```


- Show details of a test (lynis show details TEST-ID)
- Check the logfile for all details (less /var/log/lynis.log)
- Read security controls texts (https://cisofy.com)
- Use --upload to upload data to central system (Lynis Enterprise users)
Lynis security scan details:
Hardening index : 67 [############]
Tests performed : 277
Plugins enabled : 1
Components:
- Firewall [V]
- Malware scanner [V]
Scan mode:
Normal [V] Forensics [ ] Integration [ ] Pentest [ ]
Lynis modules:
- Compliance status [?]
- Security audit [V]
- Vulnerability scan [V]
Files:
- Test and debug information : /var/log/lynis.log
- Report data : /var/log/lynis-report.dat
Lynis 3.1.4
Auditing, system hardening, and compliance for UNIX-based systems
(Linux, macOS, BSD, and others)
2007-2024, CISOfy - https://cisofy.com/lynis/
Enterprise support available (compliance, plugins, interface and tools)
[TIP]: Enhance Lynis audits by adding your settings to custom.prf (see /etc/lynis/default.prf for all settings)

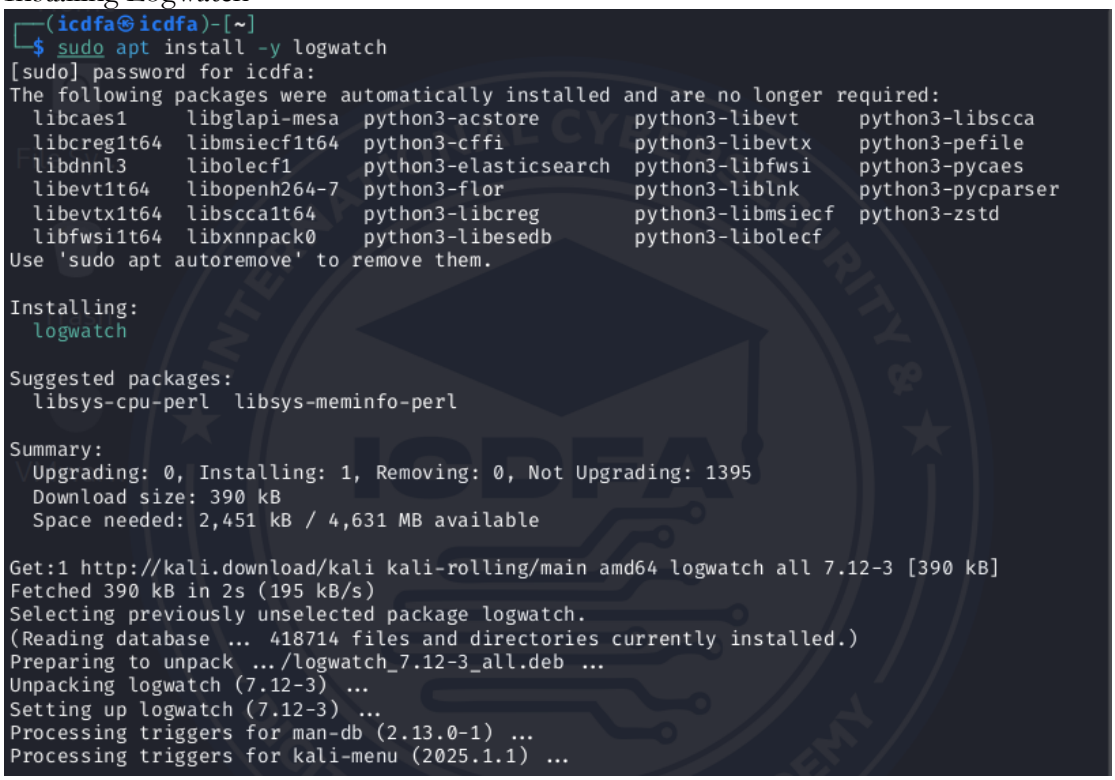
Saving the audit results


Lynis security scan details:
Hardening index : 67 [##############   ]
Tests performed : 277
Plugins enabled : 1
Components:
- Firewall [V]
- Malware scanner [V]
Scan mode:
Normal [V] Forensics [ ] Integration [ ] Pentest [ ]
Lynis modules:
- Compliance status [?]
- Security audit [V]
- Vulnerability scan [V]
Files:
- Test and debug information : /var/log/lynis.log
- Report data : /var/log/lynis-audit.log
Lynis 3.1.4
Auditing, system hardening, and compliance for UNIX-based systems
(Linux, macOS, BSD, and others)
2007-2024, CISOfy - https://cisofy.com/lynis/
Enterprise support available (compliance, plugins, interface and tools)

- Screenshots showing the installation and configuration of Logwatch

Configure Logwatch for daily log analysis and reporting

Installing Logwatch



Creating a custom Logwatch configuration

Running Logwatch manually to test

Has an error

- The security_check_report.txt file generated by your script

Creating a security check script

```
┌──(icdfa㉿icdfa)-[~]
└─$ >....
 -10
echo

# Check for unowned files
echo "Unowned files (sample):"
sudo find / -nouser -o -nogroup -exec ls -la {} \; 2>/dev/null | head
 -10
echo

# Check for listening ports
echo "Listening ports:"
sudo netstat -tulpn | grep LISTEN
echo

# Check for failed login attempts
echo "Recent failed login attempts:"
grep "Failed password" /var/log/auth.log | tail -10
echo

# Check for successful logins
echo "Recent successful logins:"
grep "Accepted password" /var/log/auth.log | tail -10
echo

# Check for sudo usage
echo "Recent sudo usage:"
grep "sudo:" /var/log/auth.log | tail -10
echo

# Check system load
echo "System load:"
uptime
echo

# Check disk usage
echo "Disk usage:"
df -h
echo

# Check for updates
echo "Available updates:"
apt list --upgradable 2>/dev/null
echo

echo "Security check completed."
```

```
┌──(icdfa㉿icdfa)-[~]
└─$
chmod +x security_check.sh

┌──(icdfa㉿icdfa)-[~]
└─$
```

Running the security check script

```
└─$ ./security_check.sh > security_check_report.txt

[sudo] password for icdfa:

┌──(icdfa㉿icdfa)-[~]
└─$ ./security_check.sh
Security Check Report - Fri 12 Sep 2025 23:35:02 WAT
==============================

Users with empty passwords:
[sudo] password for icdfa:
root:!:20218:0:99999:7:::
systemd-network:!*:20218::::1:
dhcpcd:!:20218:::::
_sentrypeer:!:20218:::::
tss:!:20218:::::
strongswan:!:20218:::::
systemd-timesync:!*:20218::::1:
Debian-exim:!:20218:::::
uuidd:!:20218:::::
messagebus:!:20218:::::
clamav:!:20218:::::
tcpdump:!:20218:::::
redis:!:20218:::::
sshd:!:20218:::::
dnsmasq:!:20218:::::
postgres:!:20218:::::
avahi:!:20218:::::
speech-dispatcher:!:20218:::::
usbmux:!:20218:::::
nm-openvpn:!:20218:::::
inetsim:!:20218:::::
_defectdojo:!:20218:::::
nm-openconnect:!:20218:::::
lightdm:!:20218:::::
saned:!:20218:::::
polkitd:!*:20218:::::
rtkit:!:20218:::::
colord:!:20218:::::
icdfa:$y$j9T$jscDlPD2oH.IX5Nf8×33p/$OpodUloLMtNXMup91mbrFQObpQse6esbbB5o.a3wsB1:20218:0:99999:7:::
_aide:!*:20343:::::

Users with UID 0:
root:x:0:0:root:/root:/usr/bin/zsh

SUID/SGID files (sample):
```

```
libtag2/kali-rolling 2.1.1-1 amd64 [upgradable from: 2.0.2-2]
libtag2/kali-rolling 2.1.1-1 i386 [upgradable from: 2.0.2-2]
libtalloc2/kali-rolling 2:2.4.3+samba4.22.4+dfsg-1 amd64 [upgradable from: 2:2.4.2+samba4.21.4+dfsg-1]
libtcl8.6/kali-rolling 8.6.17+dfsg-1 amd64 [upgradable from: 8.6.16+dfsg-1]
libtdb1/kali-rolling 2:1.4.13+samba4.22.4+dfsg-1 amd64 [upgradable from: 2:1.4.12+samba4.21.4+dfsg-1]
libtevent0t64/kali-rolling 2:0.16.2+samba4.22.4+dfsg-1 amd64 [upgradable from: 2:0.16.1+samba4.21.4+dfsg-1]
libthunarx-3-0/kali-rolling 4.20.4-1 amd64 [upgradable from: 4.20.2-1]
libtiff6/kali-rolling 4.7.0-4 amd64 [upgradable from: 4.7.0-3]
libtiff6/kali-rolling 4.7.0-4 i386 [upgradable from: 4.7.0-3]
libtinysparql-3.0-0/kali-rolling 3.8.2-7+b1 amd64 [upgradable from: 3.8.2-7]
libtirpc-common/kali-rolling,kali-rolling 1.3.6+ds-1 all [upgradable from: 1.3.4+ds-1.3]
libtirpc3t64/kali-rolling 1.3.6+ds-1 amd64 [upgradable from: 1.3.4+ds-1.3+b1]
libtk8.6/kali-rolling 8.6.17-1 amd64 [upgradable from: 8.6.16-1]
libtotem-plparser18/kali-rolling 3.26.6-2+b1 amd64 [upgradable from: 3.26.6-2]
libtsan2/kali-rolling 15.2.0-1 amd64 [upgradable from: 14.2.0-19]
libturbojpeg0/kali-rolling 1:2.1.5-4 amd64 [upgradable from: 1:2.1.5-3.1]
libubsan1/kali-rolling 15.2.0-1 amd64 [upgradable from: 14.2.0-19]
libuchardet0/kali-rolling 0.0.8-2 amd64 [upgradable from: 0.0.8-1+b2]
libudev1/kali-rolling 257.7-1 amd64 [upgradable from: 257.5-2]
libudev1/kali-rolling 257.7-1 i386 [upgradable from: 257.5-2]
libudisks2-0/kali-rolling 2.10.90-3 amd64 [upgradable from: 2.10.1-11]
libunbound8/kali-rolling 1.23.1-1 amd64 [upgradable from: 1.22.0-1+b1]
libunibreak6/kali-rolling 6.1-3 amd64 [upgradable from: 6.1-2+b1]
libupower-glib3/kali-rolling 1.90.10-1 amd64 [upgradable from: 1.90.7-1]
liburcu8t64/kali-rolling 0.15.3-1 amd64 [upgradable from: 0.15.1-1]
liburing2/kali-rolling 2.11-1 amd64 [upgradable from: 2.9-1]
libusb-1.0-0/kali-rolling 2:1.0.29-2 amd64 [upgradable from: 2:1.0.28-1]
libusb-1.0-0/kali-rolling 2:1.0.29-2 i386 [upgradable from: 2:1.0.28-1]
libuuid1/kali-rolling 2.41.1-1 amd64 [upgradable from: 2.41-4]
libv4l-0t64/kali-rolling 1.30.1-1 amd64 [upgradable from: 1.28.1-1]
libv4l-0t64/kali-rolling 1.30.1-1 i386 [upgradable from: 1.28.1-1]
libv4lconvert0t64/kali-rolling 1.30.1-1 amd64 [upgradable from: 1.28.1-1]
libv4lconvert0t64/kali-rolling 1.30.1-1 i386 [upgradable from: 1.28.1-1]
libvolume-key1/kali-rolling 0.3.12-10 amd64 [upgradable from: 0.3.12-9]
libvpl2/kali-rolling 1:2.15.0-1 amd64 [upgradable from: 1:2.14.0-1+b1]
libvpx9/kali-rolling 1.15.0-2.1 amd64 [upgradable from: 1.15.0-2]
libvpx9/kali-rolling 1.15.0-2.1 i386 [upgradable from: 1.15.0-2]
libvte-2.91-0/kali-rolling 0.80.3-2 amd64 [upgradable from: 0.80.1-1]
libvte-2.91-common/kali-rolling 0.80.3-2 amd64 [upgradable from: 0.80.1-1]
libvulkan1/kali-rolling 1.4.321.0-1 amd64 [upgradable from: 1.4.309.0-1]
libvulkan1/kali-rolling 1.4.321.0-1 i386 [upgradable from: 1.4.309.0-1]
libwacom-common/kali-rolling,kali-rolling 2.16.1-1 all [upgradable from: 2.14.0-1]
libwacom9/kali-rolling 2.16.1-1 amd64 [upgradable from: 2.14.0-1]
```

Creating a cron job for daily security checks

```
┌──(icdfa㉿icdfa)-[~]
└─$ echo "0 5 * * * root /path/to/security_check.sh > /var/log/securi
y_check_$(date +\%Y\%m\%d).log 2>&1" | sudo tee /etc/cron.d/security
check
sudo] password for icdfa:
 5 * * * root /path/to/security_check.sh > /var/log/security_check_2
250912.log 2>&1
```

Creating a cron job for weekly AIDE checks

```
┌──(icdfa㉿icdfa)-[~]
└─$ echo "0 4 * * 0 root /usr/bin/aide.wrapper --check > /var/log/aid
e/aide-check-$(date +\%Y\%m\%d).log 2>&1" | sudo tee /etc/cron.d/aide
-weekly
0 4 * * 0 root /usr/bin/aide.wrapper --check > /var/log/aide/aide-che
ck-20250912.log 2>&1
```

Creating a cron job for monthly Lynis audits

```
┌──(icdfa㉿icdfa)-[~]
└─$ echo "0 3 1 * * root /usr/bin/lynis audit system --report-file /v
ar/log/lynis-audit-$(date +\%Y\%m).log 2>&1" | sudo tee /etc/cron.d/l
ynis-monthly

0 3 1 * * root /usr/bin/lynis audit system --report-file /var/log/lyn
is-audit-202509.log 2>&1
```

- The Lynis audit report

Download the file

We installed and configured **Logwatch** for daily log analysis, created a **security check script**, and then set up cron jobs for daily, weekly, and monthly monitoring with **AIDE** and **Lynis**. These tools shall help detect anomalies, monitor system integrity, and generate reports automatically. By providing continuous oversight and regular audits, they strengthen the organization's security governance, support compliance, and enable a quick response to potential threats.

Part 3: Security Log Analysis and Visualization

Creating a Python script to parse and analyze authentication logs:

Creating a log analysis script

```
┌──(icdfa㉿icdfa)-[~]
└─$ >....

        # Check for compromised accounts
        suspicious_users = [user for user, count in analysis_results[
'successful_users'].items() if count > 10]
        if suspicious_users:
            f.write("2. Unusually high number of logins for the follo
wing users:\n")
            for user in suspicious_users:
                f.write(f"   - {user}: {analysis_results['successful_
users'][user]} logins\n")
            f.write("   Recommendation: Verify if this activity is le
gitimate.\n\n")

        f.write("3. General recommendations:\n")
        f.write("   - Implement or strengthen fail2ban rules to block
 repeated failed login attempts\n")
        f.write("   - Consider implementing multi-factor authenticati
on\n")
        f.write("   - Review user access regularly and remove unneces
sary accounts\n")
        f.write("   - Ensure password policies enforce strong passwor
ds\n")

if __name__ == "__main__":
    if len(sys.argv) < 2:
        print("Usage: python3 analyze_auth_logs.py <auth_log_file>")
        sys.exit(1)

    log_file = sys.argv[1]
    output_prefix = "auth_analysis"

    # Parse and analyze the log file
    data = parse_auth_log(log_file)
    analysis_results = analyze_data(data)

    # Generate visualizations
    generate_visualizations(analysis_results, output_prefix)

    # Generate report
    generate_report(data, analysis_results, f"{output_prefix}_report.
txt")

    print(f"Analysis complete. Report saved to {output_prefix}_report
.txt")
    print(f"Visualizations saved as {output_prefix}_*.png")
EOF

┌──(icdfa㉿icdfa)-[~]
└─$ chmod +x analyze_auth_logs.py

┌──(icdfa㉿icdfa)-[~]
└─$
```

Installing required Python packages for the analysis script

```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo apt install -y python3-pip
The following packages were automatically installed and are no longer requ
ired:
  libcaes1       libscca1t64            python3-libfwsi
  libcreg1t64    libxnnpack0            python3-liblnk
  libdnnl3       python3-acstore        python3-libmsiecf
  libevt1t64     python3-cffi           python3-libolecf
  libevtx1t64    python3-elasticsearch  python3-libscca
  libfwsi1t64    python3-flor           python3-pefile
  libglapi-mesa  python3-libcreg        python3-pycaes
  libmsiecf1t64  python3-libesedb       python3-pycparser
  libolecf1      python3-libevt         python3-zstd
  libopenh264-7  python3-libevtx
Use 'sudo apt autoremove' to remove them.

Upgrading:
  python3-pip  python3-pip-whl

Summary:
  Upgrading: 2, Installing: 0, Removing: 0, Not Upgrading: 1393
  Download size: 2,814 kB
  Freed space: 299 kB

Get:1 http://http.kali.org/kali kali-rolling/main amd64 python3-pip all 25
.2+dfsg-1 [1,386 kB]
Get:2 http://http.kali.org/kali kali-rolling/main amd64 python3-pip-whl al
l 25.2+dfsg-1 [1,428 kB]
Fetched 2,814 kB in 2s (1,640 kB/s)
(Reading database ... 419103 files and directories currently installed.)
Preparing to unpack .../python3-pip_25.2+dfsg-1_all.deb ...
Unpacking python3-pip (25.2+dfsg-1) over (25.0.1+dfsg-1) ...
Preparing to unpack .../python3-pip-whl_25.2+dfsg-1_all.deb ...
Unpacking python3-pip-whl (25.2+dfsg-1) over (25.0.1+dfsg-1) ...
Setting up python3-pip-whl (25.2+dfsg-1) ...
Setting up python3-pip (25.2+dfsg-1) ...
Processing triggers for man-db (2.13.0-1) ...
Processing triggers for kali-menu (2025.1.1) ...
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ pip3 install matplotlib --break-system-packages
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: matplotlib in /usr/lib/python3/dist-packages (3.8.3)
Requirement already satisfied: contourpy≥1.0.1 in /usr/lib/python3/dist-packages (from matp
lotlib) (1.3.1)
Requirement already satisfied: cycler≥0.10 in /usr/lib/python3/dist-packages (from matplotl
ib) (0.12.1)
Requirement already satisfied: fonttools≥4.22.0 in /usr/lib/python3/dist-packages (from mat
plotlib) (4.55.3)
Requirement already satisfied: kiwisolver≥1.3.1 in /usr/lib/python3/dist-packages (from mat
plotlib) (1.4.7)
Requirement already satisfied: numpy<2,≥1.21 in /usr/lib/python3/dist-packages (from matplo
tlib) (1.26.4)
Requirement already satisfied: packaging≥20.0 in /usr/lib/python3/dist-packages (from matpl
otlib) (24.2)
Requirement already satisfied: pillow≥8 in /usr/lib/python3/dist-packages (from matplotlib)
 (11.1.0)
Requirement already satisfied: pyparsing≥2.3.1 in /usr/lib/python3/dist-packages (from matp
lotlib) (3.1.2)
Requirement already satisfied: python-dateutil≥2.7 in /usr/lib/python3/dist-packages (from
matplotlib) (2.9.0)
```

Run the log analysis script on the authentication logs

```
┌──(icdfa㉿icdfa)-[~]
└─$ python3 analyze_auth_logs.py /var/log/auth.log
Analysis complete. Report saved to auth_analysis_report.txt
Visualizations saved as auth_analysis_*.png
```

Creating a Python script to analyze and visualize audit logs

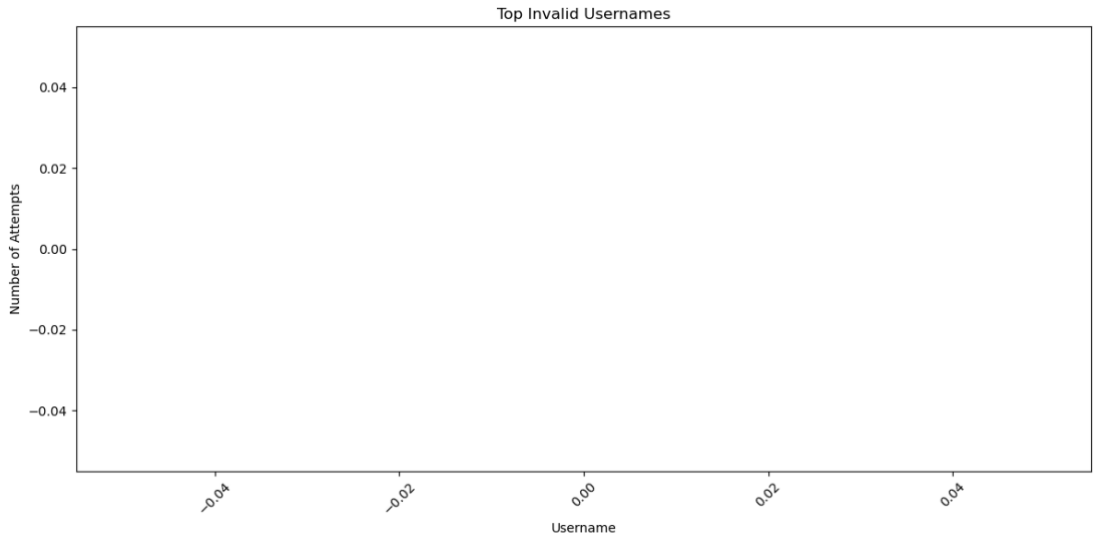
```
┌──(icdfa㉿icdfa)-[~]
└─$ >....
        # Check for unusual executables
        common_exes = {'/usr/bin/sudo', '/usr/bin/su', '/usr/bin/passwd',
'/usr/bin/ssh'}
        unusual_exes = [exe for exe in analysis_results['event_executables
'] if exe not in common_exes and analysis_results['event_executables'][exe
] > 5]

        if unusual_exes:
            f.write("2. Review usage of these executables with high audit
event counts:\n")
            for exe in unusual_exes[:5]:
                f.write(f"   - {exe}: {analysis_results['event_executables
'][exe]} events\n")
            f.write("\n")

        f.write("3. General recommendations:\n")
        f.write("   - Review audit configuration to ensure all security-re
levant events are captured\n")
        f.write("   - Implement regular review of audit logs as part of se
curity operations\n")
        f.write("   - Consider implementing automated alerting for suspici
ous audit events\n")
        f.write("   - Ensure audit logs are backed up and retained accordi
ng to policy\n")

if __name__ == "__main__":
    output_prefix = "audit_analysis"

    # Get and parse audit data
    audit_data = get_audit_data()
    parsed_data = parse_audit_data(audit_data)

    # Analyze the data
    analysis_results = analyze_audit_data(parsed_data)

    # Generate visualizations
    generate_visualizations(analysis_results, output_prefix)

    # Generate report
    generate_report(parsed_data, analysis_results, f"{output_prefix}_repor
t.txt")
    print(f"Analysis complete. Report saved to {output_prefix}_report.txt"
)
    print(f"Visualizations saved as {output_prefix}_*.png")
EOF

┌──(icdfa㉿icdfa)-[~]
└─$
```

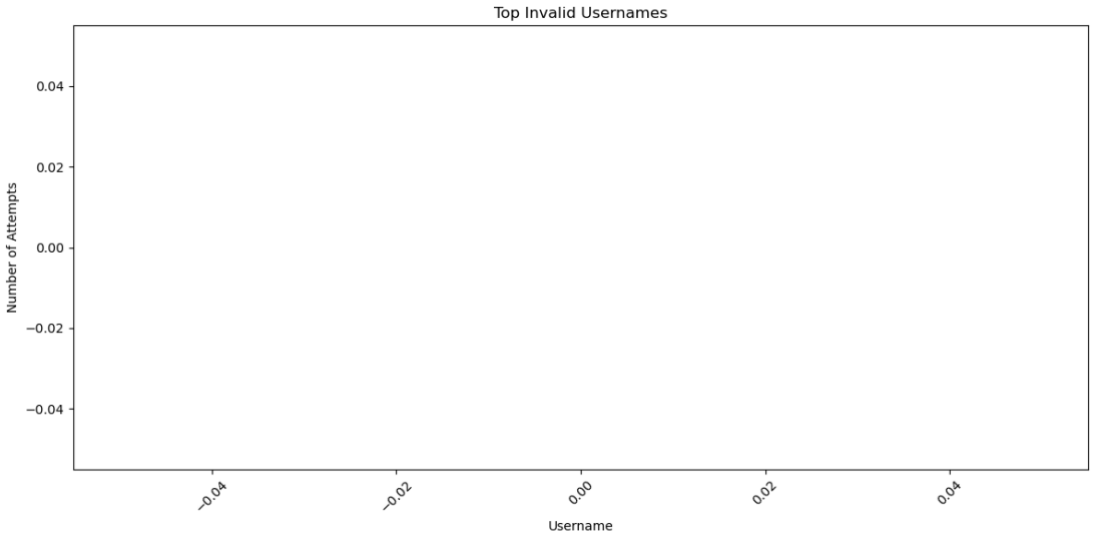
```
┌──(icdfa㉿icdfa)-[~]
└─$ chmod +x security_dashboard.py
chmod: cannot access 'security_dashboard.py': No such file or directory

┌──(icdfa㉿icdfa)-[~]
└─$
```

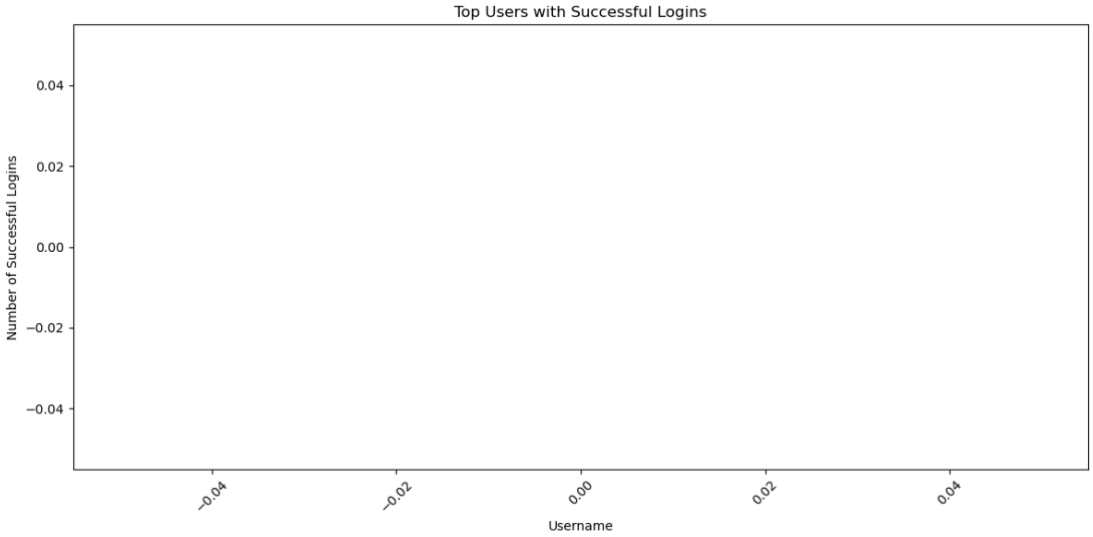
Run the dashboard script

```
┌──(icdfa㉿icdfa)-[~]
└─$ python3 security_dashboard.py

python3: can't open file '/home/icdfa/security_dashboard.py': [Errno 2] No
 such file or directory

┌──(icdfa㉿icdfa)-[~]
└─$
```

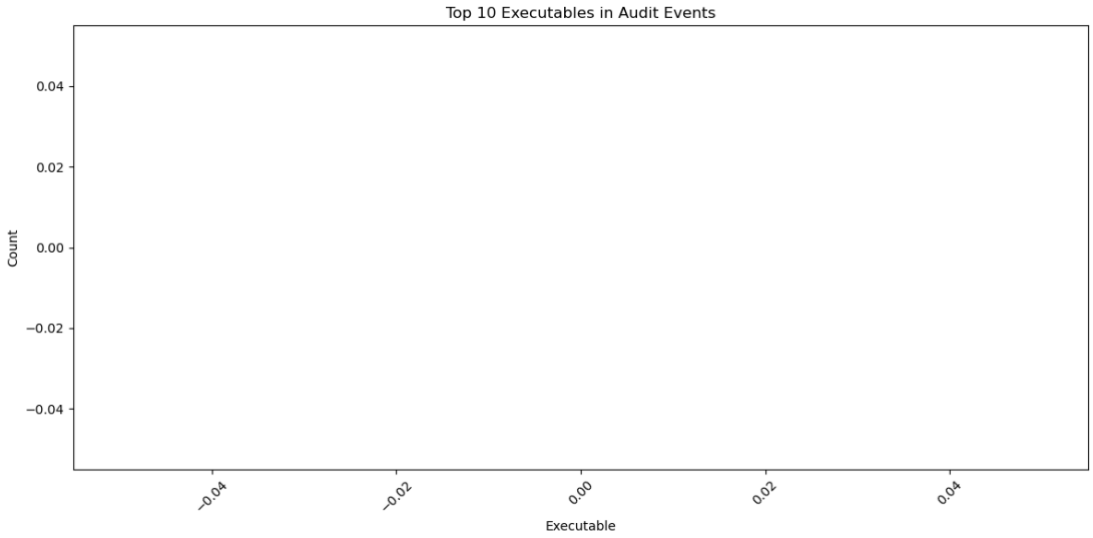
Deliverables:
The auth_analysis_report.txt file generated by your script
https://drive.google.com/file/d/1BUVZtDziRmdB8Nx1jfflTqmx-oiXZZEQ/view?usp=sharing

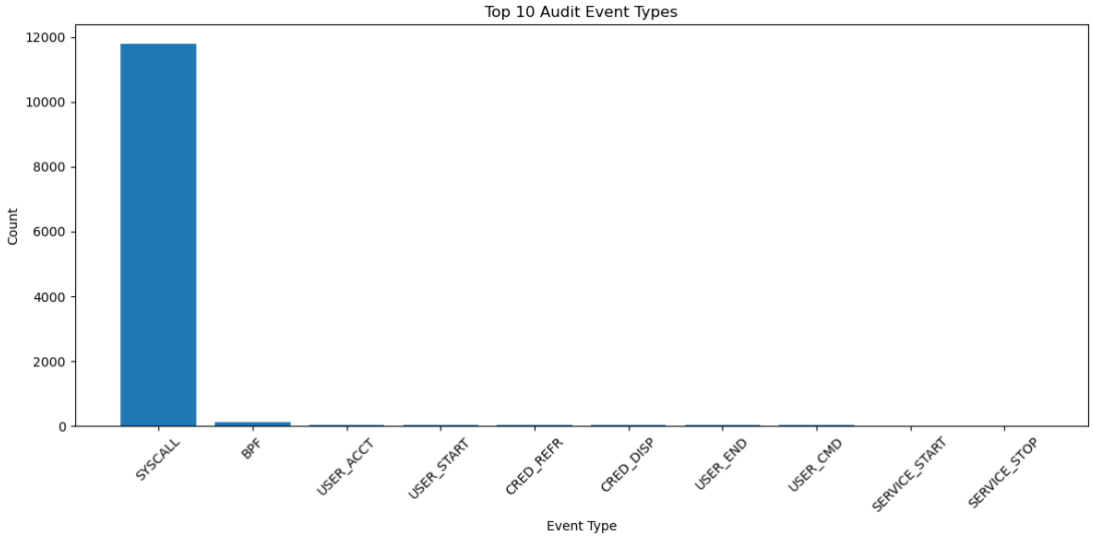


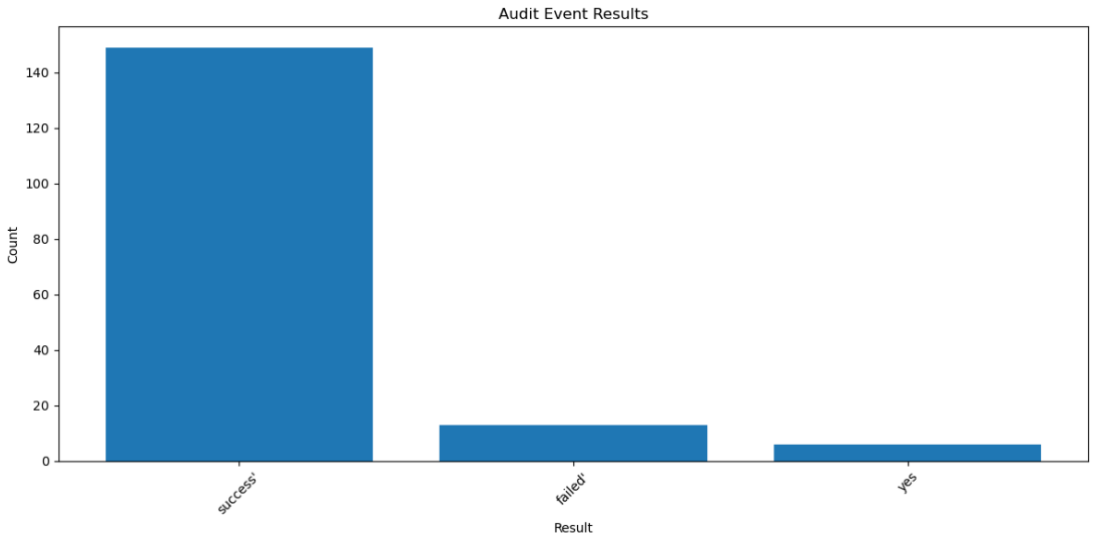


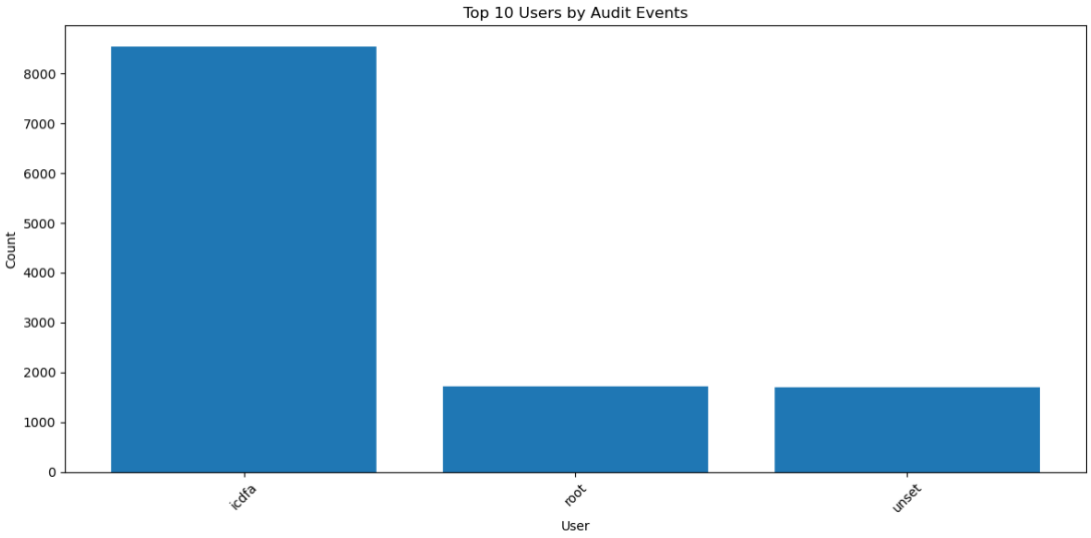


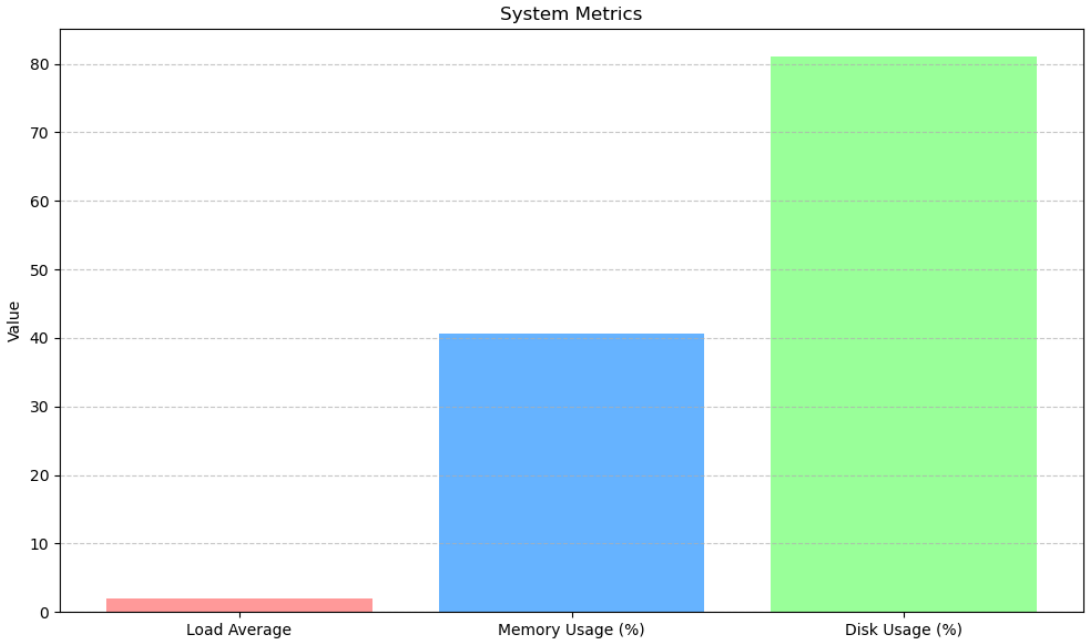
The audit_analysis_report.txt file generated by your script
https://drive.google.com/file/d/1lAOTwSu5y_FvvAyx0UoNHw9t6vqfShAt/view?usp=sharing
The security_dashboard.html file
Screenshots of the visualizations generated by your scripts

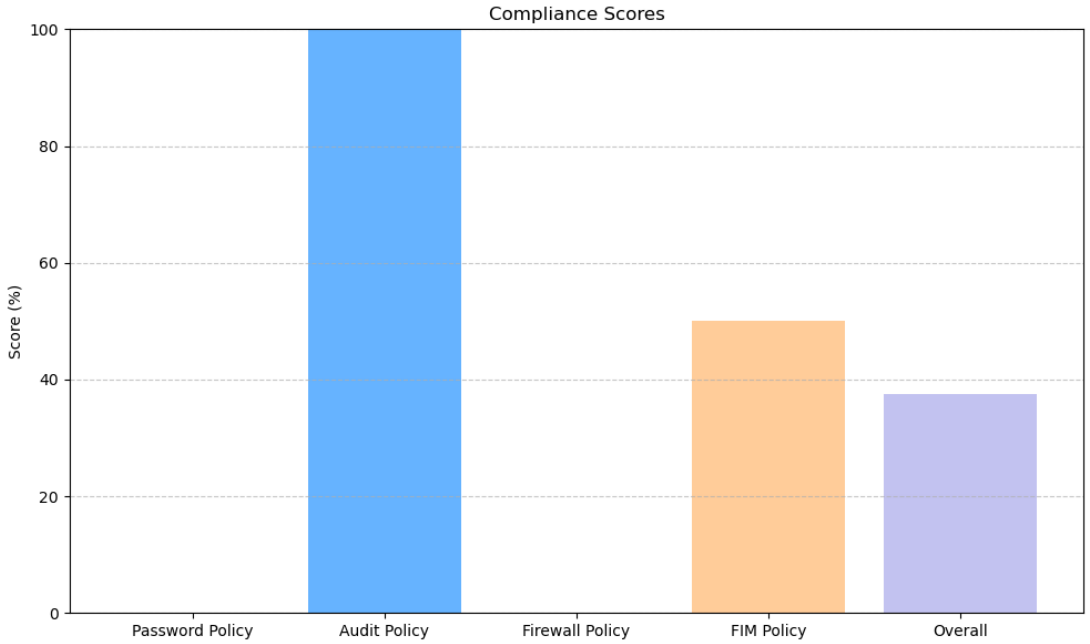

Top 10 Executables in Audit Events
Count
0.04
0.02
0.00
−0.02
−0.04
−0.04
−0.02
0.00
0.02
0.04
Executable


Top 10 Audit Event Types
Count
12000
10000
8000
6000
4000
2000
0
SYSCALL
BPF
USER_ACCT
USER_START
CRED_REFR
CRED_DISP
USER_END
USER_CMD
SERVICE_START
SERVICE_STOP
Event Type


Audit Event Results
Count
140
120
100
80
60
40
20
0
success'
failed'
yes
Result


Top 10 Users by Audit Events
Count
8000
7000
6000
5000
4000
3000
2000
1000
0
icdfa
root
unset
User





The log analysis and visualization tools help to improve security monitoring by providing structured insights into authentication and system events. Since raw logs are not easy to interpret, automated scripts are used to summarize failed logins, unusual audit events, and suspicious activities. Visual dashboards are used to make it easy to understand patterns, such as brute force attempts in system activity. The collaboration of these tools supports detection and response, thus strengthening security governance.

Part 4: Implementing Continuous Monitoring

Create a comprehensive security monitoring script that runs daily checks:
Create a daily security monitoring script

```
└─$ >....
UPDATES=$(apt list --upgradable 2>/dev/null | grep -c upgradable)
if [ "$UPDATES" -gt 0 ]; then
    echo "- RECOMMENDATION: Updates available: $UPDATES" >> $REPORT_FILE
fi

# Check for high system load
LOAD=$(cat /proc/loadavg | awk '{print $1}')
if (( $(echo "$LOAD > 2.0" | bc -l) )); then
    echo "- WARNING: High system load: $LOAD" >> $REPORT_FILE
fi

# Check for disk space
DISK_USAGE=$(df / | tail -1 | awk '{print $5}' | tr -d '%')
if [ "$DISK_USAGE" -gt 90 ]; then
    echo "- WARNING: High disk usage: $DISK_USAGE%" >> $REPORT_FILE
fi

# Check for failed logins
FAILED_LOGINS=$(grep "Failed password" /var/log/auth.log | grep "$(date "+
%b %e")" | wc -l)
if [ "$FAILED_LOGINS" -gt 10 ]; then
    echo "- WARNING: High number of failed logins today: $FAILED_LOGINS" >
> $REPORT_FILE
fi

# Generate HTML dashboard
if [ -f /usr/bin/python3 ]; then
    # Run the security dashboard script if it exists
    if [ -f /path/to/security_dashboard.py ]; then
        python3 /path/to/security_dashboard.py
        cp security_dashboard.html $HTML_REPORT
    fi
fi

echo "" >> $REPORT_FILE
echo "Report completed at $(date)" >> $REPORT_FILE

# Send email notification (uncomment and configure for production use)
# mail -s "Daily Security Report - $(hostname) - $(date +%Y-%m-%d)" admin@
example.com < $REPORT_FILE

echo "Security monitoring completed. Report saved to $REPORT_FILE"
if [ -f $HTML_REPORT ]; then
    echo "HTML dashboard saved to $HTML_REPORT"
fi
EOF
```

```
┌──(icdfa㉿icdfa)-[~]
└─$
chmod +x daily_security_monitor.sh

┌──(icdfa㉿icdfa)-[~]
└─$
```

Creating a script to monitor for security control changes:

```
└─$ >....
        echo "Previous checksum: $BASELINE_SHADOW_MD5" >> $REPORT_FILE
        echo "Current checksum: $CURRENT_SHADOW_MD5" >> $REPORT_FILE
        echo "" >> $REPORT_FILE

        # Update baseline
        echo "$CURRENT_SHADOW_MD5" > "$SHADOW_FILE"
    else
        echo "UNCHANGED: User passwords (/etc/shadow)" >> $REPORT_FILE
    fi
else
    # Create baseline if it doesn't exist
    echo "$CURRENT_SHADOW_MD5" > "$SHADOW_FILE"
    echo "BASELINE CREATED: User passwords (/etc/shadow)" >> $REPORT_FILE
fi

# Check group file
CURRENT_GROUP_MD5=$(md5sum /etc/group | awk '{print $1}')
if [ -f "$GROUP_FILE" ]; then
    BASELINE_GROUP_MD5=$(cat "$GROUP_FILE")
    if [ "$CURRENT_GROUP_MD5" != "$BASELINE_GROUP_MD5" ]; then
        echo "CHANGED: Group accounts (/etc/group)" >> $REPORT_FILE
        echo "Previous checksum: $BASELINE_GROUP_MD5" >> $REPORT_FILE
        echo "Current checksum: $CURRENT_GROUP_MD5" >> $REPORT_FILE
        echo "" >> $REPORT_FILE

        # Update baseline
        echo "$CURRENT_GROUP_MD5" > "$GROUP_FILE"
    else
        echo "UNCHANGED: Group accounts (/etc/group)" >> $REPORT_FILE
    fi
else
    # Create baseline if it doesn't exist
    echo "$CURRENT_GROUP_MD5" > "$GROUP_FILE"
    echo "BASELINE CREATED: Group accounts (/etc/group)" >> $REPORT_FILE
fi

echo "" >> $REPORT_FILE
echo "Report completed at $(date)" >> $REPORT_FILE

# Send email notification (uncomment and configure for production use)
# mail -s "Security Control Changes - $(hostname) - $(date +%Y-%m-%d)" adm
in@example.com < $REPORT_FILE

echo "Security control monitoring completed. Report saved to $REPORT_FILE"

EOF
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ chmod +x monitor_security_controls.sh

┌──(icdfa㉿icdfa)-[~]
└─$
```

Creating a security metrics script

```
└─$ >....

def save_metrics_history(metrics):
    history_file = "/var/lib/security_metrics/metrics_history.json"
    os.makedirs(os.path.dirname(history_file), exist_ok=True)

    # Load existing history
    history = []
    if os.path.exists(history_file):
        try:
            with open(history_file, 'r') as f:
                history = json.load(f)
        except:
            history = []

    # Add current metrics with timestamp
    metrics['timestamp'] = datetime.datetime.now().isoformat()
    history.append(metrics)

    # Keep only last 30 days
    if len(history) > 30:
        history = history[-30:]

    # Save updated history
    with open(history_file, 'w') as f:
        json.dump(history, f, indent=2)

if __name__ == "__main__":
    output_prefix = "security_metrics"
    output_file = f"{output_prefix}_report.txt"

    # Get metrics
    metrics = get_metrics()

    # Generate visualizations
    generate_visualizations(metrics, output_prefix)

    # Generate report
    generate_report(metrics, output_file)

    # Save metrics history
    save_metrics_history(metrics)

    print(f"Security metrics generated. Report saved to {output_file}")
    print(f"Visualizations saved as {output_prefix}_*.png")
EOF
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ chmod +x security_metrics.py

┌──(icdfa㉿icdfa)-[~]
└─$
```

Schedule the monitoring scripts to run automatically:
Creating cron jobs for the monitoring scripts
https://drive.google.com/file/d/1Yel1p_UOghIG2NAHBUZhf0friZK0Ph2G/view?usp=sharing

Create a script to simulate security events for testing:

Creating a script to simulate security events

```
┌──(icdfa㉿icdfa)-[~]
└─$ echo "0 8 * * * root /path/to/security_metrics.py > /var/log/security_
reports/metrics_\$(date +\%Y\%m\%d).log 2>&1" | sudo tee /etc/cron.d/secur
ity-metrics

0 8 * * * root /path/to/security_metrics.py > /var/log/security_reports/me
trics_$(date +\%Y\%m\%d).log 2>&1

┌──(icdfa㉿icdfa)-[~]
└─$ cat > simulate_security_events.sh << 'EOF'
#!/bin/bash

echo "Simulating security events for testing..."

# Simulate failed login attempts
for i in {1..5}; do
    ssh -o BatchMode=yes -o ConnectTimeout=5 nonexistentuser@localhost 2>/
dev/null || true
    ssh -o BatchMode=yes -o ConnectTimeout=5 root@localhost 2>/dev/null ||
 true
done

# Simulate successful login
sudo su - $(whoami) -c "echo 'Simulated login'"

# Simulate file access
sudo cat /etc/shadow 2>/dev/null || true

# Simulate file changes
sudo touch /tmp/test_security_file
sudo rm /tmp/test_security_file

# Simulate sudo usage
sudo ls -la /root

# Simulate failed sudo
echo "wrongpassword" | sudo -S ls 2>/dev/null || true

echo "Security events simulation completed."
EOF
```

```
┌──(icdfa㉿icdfa)-[~]
└─$ chmod +x simulate_security_events.sh

┌──(icdfa㉿icdfa)-[~]
└─$
```

Run the simulation script

```
rtkit:!:20218::::::
colord:!:20218::::::
icdfa:$y$j9T$jscDlPD2oH.IX5Nf8×33p/$OpodUloLMtNXMup91mbrFQObpQse6esbbB5o.a
3wsB1:20218:0:99999:7:::
_aide:!*:20343::::::
total 96
drwx------ 10 root root  4096 May 11 13:41 .
drwxr-xr-x 19 root root  4096 Sep 12 20:41 ..
-rw-r--r--  1 root root  5551 May 10 19:53 .bashrc
-rw-r--r--  1 root root   607 May 10 19:53 .bashrc.original
drwx------  7 root root  4096 May 11 05:07 .cache
drwx------  6 root root  4096 May 11 06:41 .config
drwx------  3 root root  4096 May 10 21:18 .dbus
-rw-r--r--  1 root root 11656 May 10 20:11 .face
lrwxrwxrwx  1 root root    11 May 10 20:11 .face.icon → /root/.face
drwx------  2 root root  4096 May 10 21:18 .gvfs
-rw-r--r--  1 root root  1598 May 11 05:47 installation-report.txt
drwxr-xr-x  4 root root  4096 May 11 05:47 lab
drwxrwxr-x  3 root root  4096 May 10 21:18 .local
drwxr-xr-x  4 root root  4096 May 11 05:39 .npm
-rw-r--r--  1 root root   132 Feb 17  2025 .profile
drwx------  2 root root  4096 May 10 19:11 .ssh
-rw-r-----  1 root root     4 May 11 13:41 .vboxclient-display-svga-x11-tt
y1-control.pid
-rw-r--r--  1 root root   210 May 11 11:16 .wget-hsts
-rw-------  1 root root   357 May 11 06:42 .zsh_history
-rw-r--r--  1 root root 10988 May 11 05:47 .zshrc
analyze_audit_logs.py               Music
analyze_auth_logs.py                Pictures
auth_analysis_failed_ips.png        Public
auth_analysis_invalid_users.png     security_check_report.txt
auth_analysis_report.txt            security_check.sh
auth_analysis_successful_users.png  security_metrics.py
daily_security_monitor.sh           simulate_security_events.sh
Desktop                             Templates
Documents                           test_logging.sh
Downloads                           time_decode_env
get-pip.py                          tools
installation-report.txt             Videos
lab                                 Vinetto
monitor_security_controls.sh
Security events simulation completed.

┌──(icdfa㉿icdfa)-[~]
└─$
```

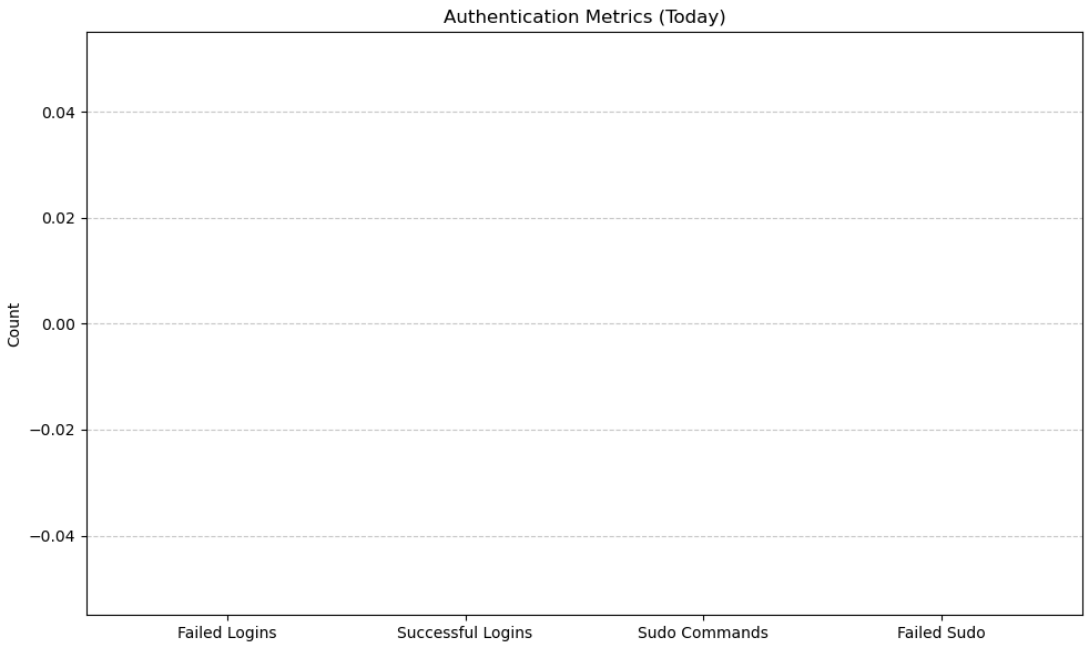
Run the monitoring scripts

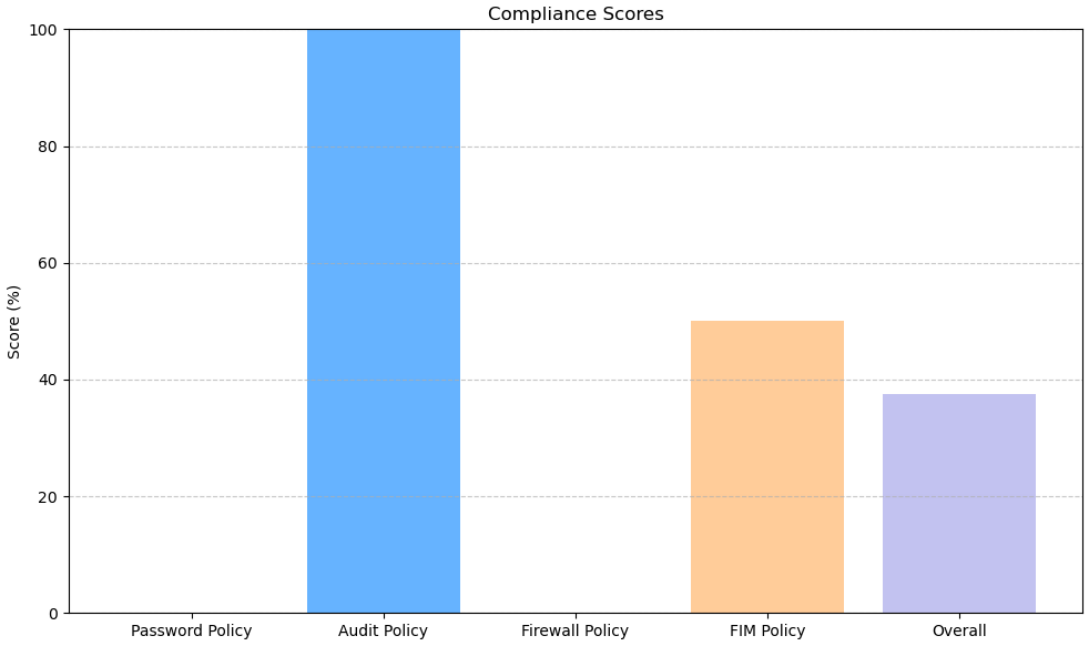
```
┌──(icdfa㉿icdfa)-[~]
└─$ cat /var/log/control_changes.txt
=== Control Change Monitoring ===
Sat 13 Sep 2025 00:42:14 WAT
-r--r----- 1 root root 1714 Feb  9  2025 /etc/sudoers
76d0f5775326cea72600a8d590342ca1173403e5bee040fbfc9bded896492c98  /etc/sudoers
-w /etc/passwd -p wa -k identity
-w /etc/group -p wa -k identity
-w /etc/shadow -p wa -k identity
-w /etc/gshadow -p wa -k identity
-w /etc/security/opasswd -p wa -k identity
-w /etc/pam.d -p wa -k system-auth
-w /etc/nsswitch.conf -p wa -k system-auth
-w /etc/ssh/sshd_config -p wa -k system-auth
-a always,exit -F arch=b64 -S execve -F key=exec
-a always,exit -F arch=b32 -S execve -F key=exec
-w /usr/bin/sudo -p x -k privileged
-w /usr/bin/su -p x -k privileged
-w /usr/bin/passwd -p x -k privileged
-w /usr/bin/chage -p x -k privileged
-w /usr/bin/gpasswd -p x -k privileged
-w /usr/bin/chsh -p x -k privileged
-w /usr/bin/mount -p x -k privileged
-w /usr/bin/umount -p x -k privileged
-w /etc -p wa -k system-config
-w /var/log -p wa -k log-write
-w /usr/bin -p wa -k binary-modification
-w /usr/sbin -p wa -k binary-modification
-w /bin -p wa -k binary-modification
-w /sbin -p wa -k binary-modification
-a always,exit -F arch=b64 -S open,openat,open_by_handle_at -F exit=-EACCES -F key=access
-a always,exit -F arch=b32 -S open,openat,open_by_handle_at -F exit=-EACCES -F key=access
-a always,exit -F arch=b64 -S open,openat,open_by_handle_at -F exit=-EPERM -F key=access
-a always,exit -F arch=b32 -S open,openat,open_by_handle_at -F exit=-EPERM -F key=access
```

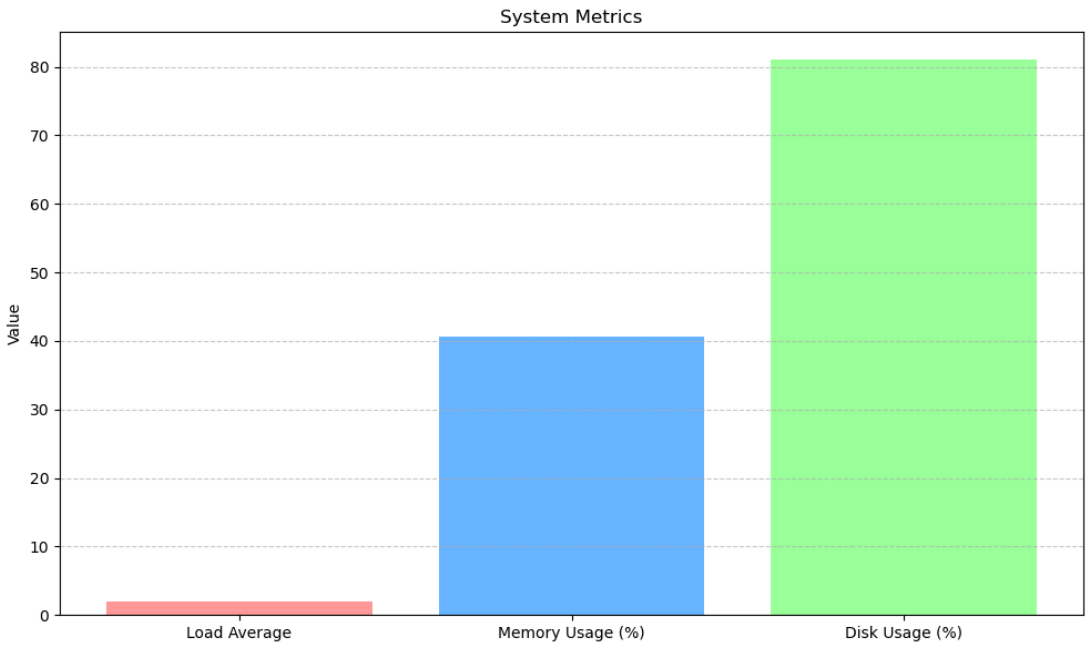
```
┌──(icdfa㉿icdfa)-[~]
└─$ sudo python3 security_metrics.py
Security metrics generated. Report saved to security_metrics_report.txt
Visualizations saved as security_metrics_*.png

┌──(icdfa㉿icdfa)-[~]
└─$
```

Deliverables:
The security_report.txt file generated by the daily monitoring script
https://drive.google.com/file/d/18lsjCb079w15wJkqwDraMd0c1gtVc6NT/view?usp=sharing

The control_changes.txt file generated by the control monitoring script
The security_metrics_report.txt file and associated visualizations
https://drive.google.com/file/d/1HZxqsAAv8rU9qTCN_wlzKSa8DItlkRFA/view?usp=sharing


Authentication Metrics (Today)
Count
0.04
0.02
0.00
−0.02
−0.04
Failed Logins
Successful Logins
Sudo Commands
Failed Sudo


Compliance Scores
Score (%)
100
80
60
40
20
0
Password Policy
Audit Policy
Firewall Policy
FIM Policy
Overall



Consistently checking and detection of deviations of critical controls are strategies for continous monitoring which support security governance. Automated scripts collect from integrity results (AIDE), audit findings (Lynis), and real-time intrusion prevention (Fail2ban), making security posture transparent. Scheduled cron jobs are used to guarantee monitoring runs smoothly without human interveniton, while simulation tests verify that alerts trigger are correct. Monitoring enables organizations to detect risks faster and maintain governance frameworks compliance.